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New Welding Processes

Two Methods of Producing Ductile Welds Developed Simultaneously in Different Laboratories of General Electric Company

Two methods for producing ductile welds have been developed by research scientists of the General Electric Company, working in different laboratories hundreds of miles apart. Both of the methods, similar in some respects, mark a decided step in the utilization of the heat of electric arcs in the joining of metal parts or the building of metal structures. The one was developed in the Schenectady research laboratory by Dr. Irving Langmuir; the other was developed in the Thomson research laboratory at Lynn, Mass., by Peter Alexander.

In both processes, air is excluded from the metal by means of a bath of hydrogen or other gas. The formation of oxides and nitrides in the weld metal is thus prevented, and the fused metal is as strong and ductile as the original metal.

Announcements of these radically new methods of arc welding are made in the March issue of the General Electric Review. In brief, the method developed by Dr. Langmuir in Schenectady is to pass a stream of hydrogen between two electrodes. The heat of the arc breaks up the hydrogen molecules into atoms. These combine again a short distance in front of the arc into molecules of the gas, and in so doing liberate an enormous amount of heat, so that much higher temperatures can be obtained with this than with the usual welding methods. Since atomic hydrogen is a powerful reducing agent, it reduces any oxides which might otherwise form on the surface of the metal. Alloys containing chromium, aluminum, silicon or manganese can thus be welded without fluxes and without surface oxidation.

The process developed in the Lynn laboratory by Mr. Alexander is based on the utilization of the chemical and physical properties of hydrogen and other gases in their molecular state. This process aims primarily at the prevention of the formation of the nitrides and oxides in the arc-deposited metal, which limit the ductility of the usual arc welds.

In this process the arc is struck between the metallic wire or carbon used as one electrode and the plate or work to be welded used as another electrode. The crater of the arc is always on the work to be welded. The gaseous atmosphere is supplied in a form of a stream around the arc. Pure hydrogen, water gas, hydrogen-nitrogen mixtures, anhydrous ammonia, methanol vapor and some other suitable gases can be used, according to the nature of the work. The hydrogen-carbon monoxide mixtures were suggested by Professor Elihu Thomson; water gas and methanol are examples of such mixtures.

Most of the non-ferrous metals and alloys can be welded by this process in suitable gaseous mixtures.

Atomic Hydrogen Arc Welding, As Developed in the Schenectady Research Laboratory of the General Electric Company

Fifteen years ago, while studying the loss of heat of the tungsten filaments of incandescent lamps in an atmosphere of hydrogen gas, Dr. Irving Langmuir of the General Electric research laboratory at Schenectady found that at a high temperature the hydrogen gas changed from the molecular to the atomic state. In the molecular state, two atoms of the gas are grouped together as a unit; in the atomic state each atom acts as a unit. The molecular form is the more stable, and when the atoms recombine to form the molecules intense heat is liberated.

Dr. Langmuir's study of the filaments in hydrogen was a theoretical investigation. Now, fifteen years later, the results have been applied in a different field—in the development of a new method of welding, by which it is possible to produce welds as strong and as ductile as the original materials.

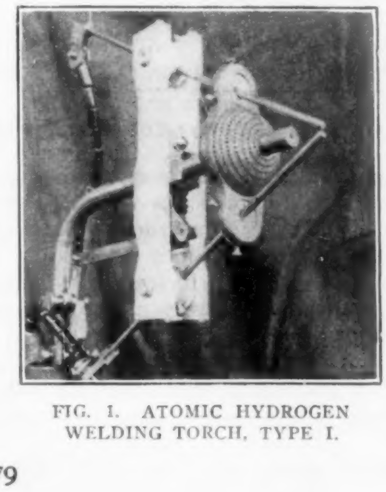


FIG. 1. ATOMIC HYDROGEN WELDING TORCH, TYPE I.

Continuing the theoretical investigation, Dr. Langmuir found that more atomic hydrogen was formed by passing powerful electric arcs between tungsten electrodes at atmospheric pressure. By directing a jet of hydrogen from a small tube into the arc, the atomic hydrogen could be blown out of the arc, forming an intensely hot flame of atomic hydro-

gen burning to the molecular form and liberating about half again as much heat as does the oxyhydrogen flame. In this flame molybdenum, one of the most refractory of metals, melts with ease; quartz, however, melts less easily, in spite of its lower melting point. This indicates that the metal assists in the action as a catalyzer—which scientists define as a substance which accelerates a chemical change.

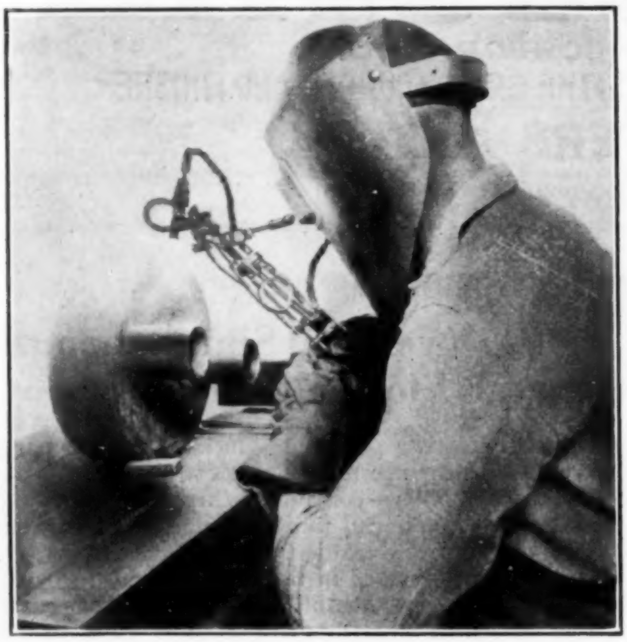


FIG. 2. WELDING WITH ATOMIC HYDROGEN WELDING TORCH, TYPE II.

The two electrodes of the torch are tungsten rods, held at an acute angle with each other by lava insulators. When not in use, the electrodes are in contact with each other; they can be separated by pressure on a lever mounted on the handle. A set screw is provided for making slow adjustments of the electrodes. The hydrogen is supplied by a tube through the handle. Sufficient gas is used so that not only are the electrode tips surrounded by enough to form the blast of atomic hydrogen but by an additional quantity to surround the work with hydrogen.

Either alternating or direct current can be used. The first mentioned has been found more convenient, and electrodes of smaller diameter can be used. The gas pressure required to operate the torch is very small; in the laboratory, with short lengths of tubing, a pressure of less than one pound per square inch was sufficient with metals up to one-half inch in thickness. For ordinary welding, the rate of gas consumption varies between 20 and 30 cubic feet per hour.

Since the maximum rate of heating is desired in welding, the torch is held close to the metal. Best results have also been obtained when the torch is inclined so that the blast of hydrogen from the torch passes over the pool of molten metal in a direction opposite to that in which the torch is moved along the line of the weld to be made.

Experiments have been conducted with several gas mixtures and various electrode materials. The best results have usually been obtained with tungsten electrodes and hydrogen alone.

Materials of many kinds have been successfully welded by this method. Welds on deoxidized copper such as silicon-copper have been made up to three-eighths inch thick metal, giving unusually good sections.

Electric Arc Welding in Gaseous Atmosphere

By surrounding the ordinary welding electrodes with an atmosphere of hydrogen or certain other gases, it has been found by Peter Alexander of the Thomson Research Laboratory of the General Electric Company at Lynn, Mass., that it is possible to produce ductile welds. The gas acts as a flux and shield against the oxygen and

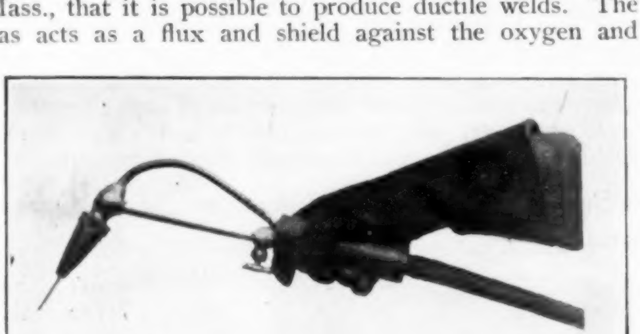


FIG. 3. SEMI-AUTOMATIC WELDING TORCH

nitrogen of the air; therefore the formation of oxides and nitrides of iron in the molten metal is prevented. The process originated from the study of metallurgy of the arc-deposited metal and the causes that limit its ductility.

The method is based on the action of molecular hydrogen. This gas at high temperatures, even in the molecular state, is a very active reducing agent. When it surrounds the crater of the arc it acts in the same way as it does in the hydrogen brazing process. Yet certain peculiarities of the process (for example, the extremely high voltage drop at cathode and anode of the arc burning in hydrogen) are due to the dissociation of the small amounts of molecular hydrogen in actual contact with the craters. Hence the apparent resistance of the arc, and consequently the amount of energy liberated, is about double that when the arc is burning in air.

Consequently the weld is not only ductile, but the operation is much faster. The speed results both from the greater energy of the arc in the hydrogen atmosphere and the fact that beveling of the edges of the material is unnecessary. Using 180 amperes and an arc voltage

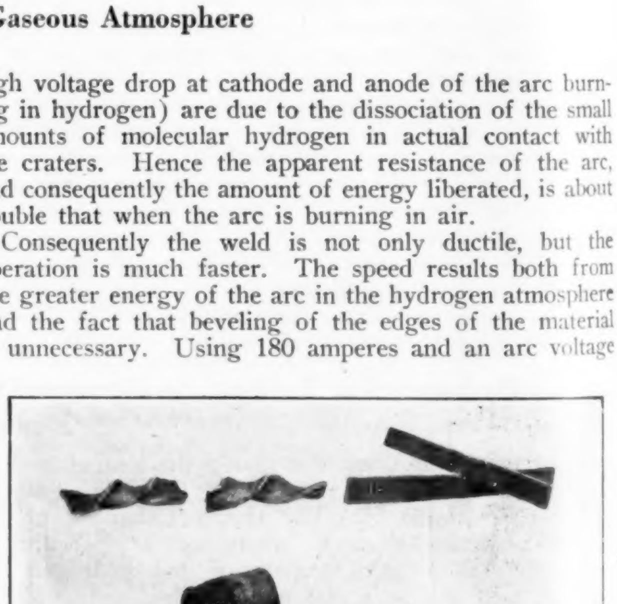


FIG. 4. SAMPLES OF WELDED MATERIALS TWISTED OR BENT 180° WITHOUT CRACKING.

of 60, one-quarter inch boiler plates, butted together without beveling, have been welded at a speed of 60 feet per hour.

In this welding process the arc is maintained inside of a hydrogen stream which burns along its outer surface of contact with air. The electrode is entirely surrounded by hydrogen, which eliminates the possibility of the metal in the crater coming in contact with air. Direct current is used. The equipment as developed in the laboratory includes the direct-current generator, gas hose, and spool of welding wire mounted as a unit on one base. The welding wire, the hydrogen gas and the electric current are sent through a flexible hose to the torch nozzle.

After the work with the hydrogen atmosphere was found to be successful, experiments with mixtures of hydrogen and carbon monoxide were conducted in accordance with Professor Elihu Thomson's suggestion, and under his personal guidance. Water gas, containing about equal volumes of hydrogen and carbon monoxide, was next tried. It was found that welds produced in such an atmosphere were ductile and easier to produce. Work with various mixtures of carbon monoxide and hydrogen, produced either synthetically or by decomposition of various organic compounds, demonstrated that ductile welds can be produced in the atmosphere of any mixture of the two gases. Methanol or synthetic wool alcohol was found to serve well in this gas, so that transportation with portable outfits is facilitated.

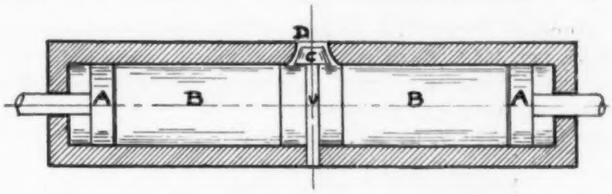
A series of experiments with nitrogen-hydrogen mixtures showed that mixtures of these gases also give ductile welds. The use of liquid anhydrous ammonia which contains one volume of nitrogen and three of hydrogen, in this connection makes it possible to store large quantities of the gas in small volume as a liquid.

Extruding Copper Pipe

Q.—We have been told that copper pipe is now successfully extruded on a hydraulic press, and we thought you might know something about this, and could recommend us to some manufacturers who are in position to quote us on this installation complete.

A.—As far as I know no one in this country is successfully extruding copper pipe. One company is offering a German extrusion press which they claim will satisfactorily extrude copper. The press will undoubtedly extrude copper tubes. Most people in this country, however, believe that the Mannesman or Steifel piercing process will make a copper tube more cheaply than the extrusion process. In extrusion it is very difficult to maintain a uniform wall thickness and that has been one of the drawbacks with its adoption here. Also the expense of tools is very high and that may make its use in America relatively more difficult than in Germany, where toolmakers' wages are low. Several concerns in this country have tried extrusion of tubes experimentally, but no one, as far as I know, is using this process commercially at the present time.—W. R. Clark.

A.—There is no machine, so far as I know, developed for the making of seamless copper tubes by the extruding process. Both brass and copper tubes are made successfully by the piercing method from a solid billet. Some years ago a machine was tried out in a Connecticut mill, for making seamless tubes by a strictly extruding process. Two billets were used, brought to a proper heat, and placed in opposite ends, of a cylinder, each chamber having a plunger working from the opposite ends towards the center, at which point the die was placed, being at right angles to the line of pressure exerted by the plungers. The plug or triplet was anchored in back of cylinder in line and extending through die. The plungers were then moved forward, bringing the billets together, and forcing the metal through the die, and around the plug.



PROPOSED SEAMLESS TUBE EXTENSION PRESS

The success of this method depended on the metal welding together perfectly under pressure. This it failed to do, and this method was abandoned.—W. J. Pettis.

Oil-Fired Furnace to Produce Ferro-Manganese

Written for The Metal Industry

By JESSE L. JONES, Metallurgical Editor

Q.—I want to produce ferro-manganese from the ore. What type of furnace do I require? I have some open flame, oil burning brass furnaces in operation now. Can I use them?

A.—Most of the Virginia manganese ores are medium or low grade, running from 20 to 40 per cent of manganese and with silica up to 10 or 15 per cent. When carbon is used for reduction of the ore, a high temperature is required, 1105° C., and a loss of 3 to 15 per cent of the manganese present is experienced, unless a very basic slag is used. In making the regular 80 per cent ferro-manganese, blast furnaces are most generally used, as they are capable of giving the temperature required and they can handle economically the large volume of slag resulting from the use of low grade ores. These operating conditions, together with the limited output of the oil-fired furnace would naturally militate against its use for smelting low grade manganese ores. With high grade ores, this furnace might be used for producing 90 per cent or higher metallic manganese. For this grade, however, the electric furnace or the alumino-thermic process is used.

Properties of An Alloy of Nickel and Copper

By H. J. Tapsell and J. Bradley*

The paper deals with the results of some mechanical tests carried out on a synthetic alloy of nickel and copper (approximately 70:30), containing 2.35 per cent of manganese, at a range of temperatures between air temperature and 700° C. to 800° C. The tests herein described consist of ordinary tensile, torsion, impact, impact hardness, fatigue under reversed stresses, and "creep."

Special attention is given to the study of the "creep" of the nickel-copper alloy, and determinations of the limiting creep stresses have been made between the temperatures 400° C. and 700° C. The paper indicates the large difference existing between the apparent ultimate strength, as determined by tests made at the ordinary rate of loading, and th safe strength, or limiting creep stress, obtained from tests made under constant loading conditions over long periods.

Some comparisons of the results obtained in the ordinary tensile tests and the creep tests on the nickel-copper alloy, and the results of other experiments on Monel metal and other alloys, are given at the conclusion of the paper.

*Abstract of a paper read at the meeting of the British Institute of Metals, March 10-11, 1926.

Monel Metal and Some Substitutes

Casting Monel Metal and the Mixing of Some High Nickel Alloys

Written for The Metal Industry by E. D. GLEASON, Foundryman

ADDITION AGENT FOR MONEL METAL

It has been my privilege to help find a remedy to overcome the evils above stated and it will be of material benefit to those interested to know of a simple and easy procedure to overcome these obstacles in large or small castings.

If the charge is melted in a reverberatory furnace, just before tapping, put into the ladle 1¼ pounds of aluminum-manganese alloy per hundred pounds of monel metal tapped. The aluminum-manganese alloy consists of 75 per cent aluminum and 25 per cent manganese. The melt after running out is quickly poured. Test bars taken from numerous heats give the following physical properties.

Ultimate tensile—73,750 pounds per sq. inch.
Yield point—30,500 pounds per sq. inch.
Elongation in 2 inches—37½ per cent.
Brinell—100.

Another charge of aluminum-manganese consisting of 3 lbs. per 100 lbs. of monel was added to the ladle under the same conditions and numerous heats developed the following physical properties.

Ultimate tensile—84,200 pounds per sq. inch.
Yield point—55,000 pounds per sq. inch.
Elongation in 2 inches—18 per cent.
Brinell—158.

When the charge is melted in crucibles, the aluminum-manganese, which comes in sticks, is pushed under the metal with a pair of tongs after which is vigorously stirred. Aluminum-manganese is a good degasifier and solidifier and the castings are solid and free from shrinkage, cracks.

SUBSTITUTES FOR MONEL METAL

Substitutes for Monel metal are legion and to this end it may not be amiss to add a few more to the list in hopes that they may be useful and interesting to those who may have a call for just such a metal. A great many heats and tests were made from an alloy containing 77 per cent copper, 20 per cent nickel and 3 per aluminum-manganese (75-25), the copper and nickel being melted down together in a crucible under a good cover of borax glass. It is better not to use any charcoal unless you desire carbon in the melt, which it will absorb up to 1%. Add the aluminum manganese with a pair of tongs, shoving it under the metal and then stirring vigorously, after which, pour. A few typical examples of the physical properties obtained are appended.

1. Ultimate tensile—104,900 pounds per sq. inch.
   Yield point—91,800 pounds per sq. inch.
   Elongation—4 per cent in 2 inches.
2. Ultimate tensile—70,500 pounds per sq. inch.
   Yield point—65,250 pounds per sq. inch.
   Elongation—7½ per cent in 2 inches.
3. Ultimate tensile—79,000 pounds per sq. inch.
   Yield point—72,000 pounds per sq. inch.
   Elongation—2 per cent in 2 inches.
4. Ultimate tensile—100,500 pounds per sq. inch.
   Yield point—91,000 pounds per sq. inch.
   Elongation—9½ per cent in 2 inches.
5. Ultimate tensile—98,000 pounds per sq. inch.
   Yield point—66,000 pounds per sq. inch.
   Elongation—9½ per cent in 2 inches.

The last two examples of this alloy were poured in green sand molds, the others being poured into baked silica sand and it would appear that the nature of the sand made no material difference. The Brinell hardness under a 1000-pound load, thirty seconds, ranges from 197 to 223 and the alloy withstood a water pressure of 800 pounds per sq. inch which was the highest the pump would record. While it machines freely, it is harder on the tool than Monel. This metal has a beautiful silver color and takes an exceptionally high polish. Unfortunately, the temperatures of the numerous heats were not taken before pouring. This should have been done to get constant and accurate results. This alloy should be poured with large pouring sprues and feeders.

Another example iron is as follows: Copper, 57 per cent; nickel, 20 per cent; Swedish iron, 20 per cent; manganese-aluminum, 3 per cent. The copper, nickel and iron were melted together under a good cover of borax glass in a crucible, first adding the iron, then the nickel and the copper, and when fused well the other elements were injected with a pair of tongs, stirred and poured. This gave the following physical properties:

Ultimate tensile—100,000 pounds per sq. inch.
Yield point—45,500 pounds per sq. inch.
Elongation—13 per cent in 2 inches.
Brinell—237.

Copper, 75 per cent; nickel, 10 per cent; Swedish iron, 10 per cent; aluminum-manganese, 5 per cent, gave the following physical properties:

Ultimate tensile—83,000 pounds per sq. inch.
Yield point—30,000 pounds per sq. inch.
Elongation—16 per cent in 2 inches.
Brinell—171.

An interesting alloy of cupro-nickel consists of 60 per cent copper; 38 per cent nickel and 2 per cent pure manganese. It can be rolled and forged hot under rolling mill conditions from the ingot to the finished product, and can be drop-forged and hammered or it can be rolled cold. It has a beautiful color and when highly polished and put into a hot solution of polysulphides its color not affected. It is an excellent metal for art work and jewelry in its many ramifications as it can be enameled and when put into a gas muffle for from 10 to 15 minutes, it will take on a permanent jet black without the use of chemicals. When highly polished it makes an excellent mirror and can be used in place of pure nickel or steel, nickel plated. It is highly resistant to polluted and acid waters.

Displacing the copper with 4 per cent zinc and using the other proportions set forth, giving it a fancy name, you have an alloy for white gold that will not turn yellow. In making this alloy, melt the copper and nickel together under a heavy cover of borax glass and when it is hot, gradually add the manganese with constant stirring. When the manganese is all added, let the pot stay in the fire for about 15 minutes before lifting. This metal has a strong affinity for gases and oxygen and the function of the manganese is to act as a bleacher and to eliminate the gases, and at the same time absorb oxygen in the melted metal.

Drop Forging Metals

A Description of British Practice. Part 2.—Aluminium Alloys*

By DROP FORGER

REMOVAL OF FIN—GRAIN OF FORGING

The removal of the fin produced in stamping is performed in much the same manner as is employed with steel. It is essential, however, that the cutting edge of the rag cutter be as sharp as possible, so as to avoid the tearing action which results from the employment of blunt cutters. Some simple stampings can be finned cold; but, with others, a slight warming is advisable. It must also be remembered that it is a very easy matter to bend these stampings out of shape, hence if the finning be done carelessly, the stamping may be bent. If this happens, then a single light blow on the dies will generally straighten up the stamping again.

As duralumin is composed of crystals like other metals, the same rules concerning the direction of flow of the grain of the material must receive consideration as is the case with other metals. Each individual stamping must be carefully considered in this connection, because it is obvious that if stresses are allowed to fall in such a direction that the grains of the metal tend to become opened out, fracture will take place much more readily than would be the case if the principal stresses were to fall across the grains of the alloy. This matter is perhaps best understood when an analogy is drawn between worked metals and wood. Both contain a definite grain, and it is evident that whilst a plank of wood possesses considerable strength when its grain runs in the normal direction, which is parallel with the length of the wood, it is extremely weak and practically useless when the grain runs across the plank. Precisely the same is the case with duralumin, and so this matter must be thought of when it is decided whether the stamping be upended or worked direct from the bar. In this same connection must the design and formation of the "use" be considered.

EXAMINATION FOR FLAWS IN STOCK MATERIAL

Duralumin stock materials, such as rolled bar and forged billets, are subject to similar ills as are generally met with in steel stocks. Internal and external flaws of several descriptions are liable to be met with in all aluminium alloys, and the presence of these should be looked for. The majority of external defects such as laps and split metal can be best detected by upending to half the original height of the material. Internal flaws can be found by selecting representative material and taking sections of them. These are then polished and etched with a solution of caustic soda in water, when all defects are usually revealed. In this connection it may be mentioned that when material is being forged, it is advisable to forge as far as possible square, and if round bar is wanted, the corners should only be forged off, and the actual rounding finished in swages. If this is not done, and round forgings are attempted to be made direct without first forging square, there is every possibility of internal flaws being formed.

HEAT TREATING

As the majority of aluminium alloys are vastly improved in mechanical properties by heat treatment, it will be well to mention the process of heat treatment of such alloys. The actual treatment consists of heating to a temperature of 480 deg. Cent. and quenching in water. The alloy is then simply allowed to rest for about seven days, *i.e.*, age, and during this time it gradually becomes harder and tougher. After about seven days no further increase of hardness or strength takes place, and the alloy possesses a tensile strength of about 23 to 26 tons per square inch. If desired, the "aging" process can be greatly accelerated by means of simply heating to a temperature of 100 deg. Cent., which is best obtained by using boiling water.

It is, of course, essential that the heat treatment be under the control of pyrometers, and the actual heating can be done in furnaces or in salt baths. The latter method is much more easily adjusted, but the salts are liable to blister the material to some extent. Furthermore, the majority of these salts are somewhat dangerous to work with when molten, as if a drop of the hot liquid salts come in contact with one's flesh, it produces a painful sore, which is very difficult to heal.

Ordinary annealing of this alloy is performed by heating to 350 deg. Cent., followed by cooling in air. This reduces the tensile strength of the alloy to about 15 tons per square inch, and although there is very little "aging" after annealing, it is clear that full heat treatment is to be preferred for finished stampings if the full advantage of the properties of the alloy are to be made use of.

POINTS IN MACHINING AND FINISHING

There is not a great deal of difference between the machineability of annealed and heat-treated duralumin; but it is probable that in the majority of cases the heat-treated material is better to machine for the reason that it tends to cut cleanly, whilst the annealed material tends to tear, somewhat in the same manner as when soft metals like copper or lead are machined.

Many different cutting compounds are recommended for machining this alloy, and any good compound will give satisfactory results, provided there is a copious supply of the compound running the while. For finishing cuts, turpentine is often employed with every success. Too heavy cutting of this alloy is not advisable, and the temperature of the metal during machining should be kept as low as possible.

When stampings have to be put into use without being machined, it is preferable to ensure that the surface is clean and possesses the characteristic and beautiful surface of these alloys. To effect this, a pickling in hot caustic soda solution is efficacious. If this is followed by a vigorous brushing with a wire brush, the desired effect will usually be achieved. But should some surface blemishes remain, the application of a solution of sulphuric acid will, in all probability, assist in the removal of them. It is perhaps superfluous to mention that both these solutions are exceedingly bad for the material if they are allowed to attack the alloy for too long a time, or if they are not entirely removed after the pickling process is complete. It is surprising to note the persistence with which small traces of these substances will cling to the alloy, and unless very careful provision is taken to ensure that the very smallest traces are removed, the alloy will soon be ruined. Running water is essential, and too much of it cannot be used. It will be as well to mention, further, that both these pickling agents are very harmful

*Part 1 was published in our April issue, pages 141-2.

to both clothing and flesh, and care should therefore be taken to ensure that they are retained in their proper place only. When making the sulphuric acid solution, the acid should be added to the water, and not the water to the acid, so as to avoid spluttering and consequent damage.

PRECAUTIONS IN HANDLING.—CORROSION

Powdered aluminium is liable to burn with an exceedingly hot reaction, and for this reason alone, apart from others, grinding of duralumin stampings is not to be advised. Filing is better, and is more easily controlled with these alloys, although it is probably more expensive to carry out. It is advisable to mention that there should not be allowed to be mixtures of iron oxide, "rust," and aluminium filings produced. Such a mixture is an explosive under certain circumstances, and, even though it does not explode when ignited, it produces a very high temperature such as is sufficient to fire a whole building if not immediately dealt with. Water is of no avail for quenching this, but sand is effective and so is carbon tetrachloride, which is contained in some of the popular fire extinguishers, but it should only be advised in an emergency, as the poisonous gas chlorine is liberated.

The storing of both aluminium alloy stock material and stampings is a matter of considerable importance. Unlike iron and steel, the oxide of aluminium is not of a distinctive and arresting color, and because of this it is often erroneously thought that aluminium alloys are not liable to corrosion. This is far from being the case, because such alloys are not good resisters of corrosion, and so, unless care is taken to avoid the possibility of it, valuable material may be lost owing to the corrosion not being noticed. This material should be stored in a dry atmosphere, and bars and stampings should be given a protective coating of acid-free mineral oil or grease. Stampings can be dipped into a solution of petroleum jelly, in petrol, or molten petroleum jelly, whilst bar and sheet material can either be smeared with the same substance, or else dipped into a bath of a solution of resin in turpentine to which has been added 2-3 per cent. of mineral oil to remove the brittleness of the resin.

This article will be concluded in an early issue.—Ed.

Some Observations on Oxygen in Copper*

By F. JOHNSON

Head of Metallurgy Department, Municipal Technical School, Birmingham, England

The author considers the advantages and disadvantages of "tough pitch" copper as compared with those of "deoxidised" copper. The chief points are:

(1) Economy of production is in favor of "tough pitch" copper, but

(2) Most technical factors such as those regarding gassing, malleability, welding, etc., are in favor of "deoxidized" copper, excepting, chiefly

(3) For electrical purposes the "tough pitch" condition is considered the best, as despite certain results of the National Physical Laboratory, Teddington, England, on unusually pure copper, a very small percentage of oxygen in commercially pure copper is considered beneficial to electrical conductivity besides improving soundness.

(4) Evidence is given to show that the cause of surface streaks on polished copper and the surface wrinkles characteristic of tough pitch copper is the presence of an oxide rich cap, though it is uncertain how far this is due to segregation or to absorption from the air.

(5) The generally accepted oxygen content of the copper-oxide eutectic is held in doubt by the author as being too low.

* Abstract of a paper in THE METAL INDUSTRY, London, England.

CONCLUSIONS

It would appear that copper in the "tough pitch" condition is the best available for purposes where high electrical conductivity is of paramount importance. No possible objection can be taken to its use in ingot form for alloying purposes. For most general engineering purposes it is quite suitable, but it cannot be denied that it is inferior to deoxidised copper (a) where reducing gases at high temperatures are encountered, (b) where severe mechanical manipulation is concerned (e.g., spinning, riveting, drawing operations, etc.), and in welding operations.

The formation of an oxide rich crust on copper cakes and wirebars is the cause of streaks and dull-cloudy surfaces on polished sheet copper. The prevention of this oxide-enrichment may be secured by casting vertically instead of horizontally, by the use of a flux, or by casting in a non-oxidizing atmosphere.

Estimation of Oxygen and Sulfur in Copper

BY W. M. BASSETT AND H. A. BEDWORTH†

The amount of oxygen present in refined copper bears an important relation to the effects of various impurities on physical properties of copper, as well as the effects of reducing gases at higher temperatures. It seems fitting at this time, when the effects of reducing gases on copper are being discussed, to describe methods that have proved satisfactory for the determination of oxygen and sulfur, and to present some results obtained by investigation of these methods in the authors' laboratory. The procedure for the determination of sulfur is closely interrelated with that for oxygen and has, therefore, been included.

1. This method is a convenient and accurate means of determining sulfur in copper, and with ordinary precautions is not subject to contamination by sulfur-bearing fumes, which are nearly unavoidable in most laboratories, and is consequently much to be preferred to the gravimetric method.

2. The amounts of selenium and tellurium ordinarily found in refined copper do not interfere with this method. With impure coppers carrying larger amounts of selenium, this element will be volatilized to some extent, and a suitable tube filled with glass wool and placed ahead of the cadmium chloride flasks will serve to retain the selenium.

†Abstract of a paper read before the Institute of Metals Division, A. I. M. E., February 15-18, 1926

Metal Spinning

A Description of the Methods and Operations*

Written for The Metal Industry by WILLIAM MASON, Metal Spinner

Of the spinning metals, iron, zinc, and aluminum are generally stamped and are seldom used in any but rather shallow shapes; silver is hammered, so there remain copper and its alloys, brass, and German silver. Brittania Metal is largely used for teapots, crevet-frames, candlesticks, etc., and is cast, stamped, and spun, but although worked with comparative ease, is hardly suitable to a beginner, who may deal with copper and its alloys, brass, and German silver.

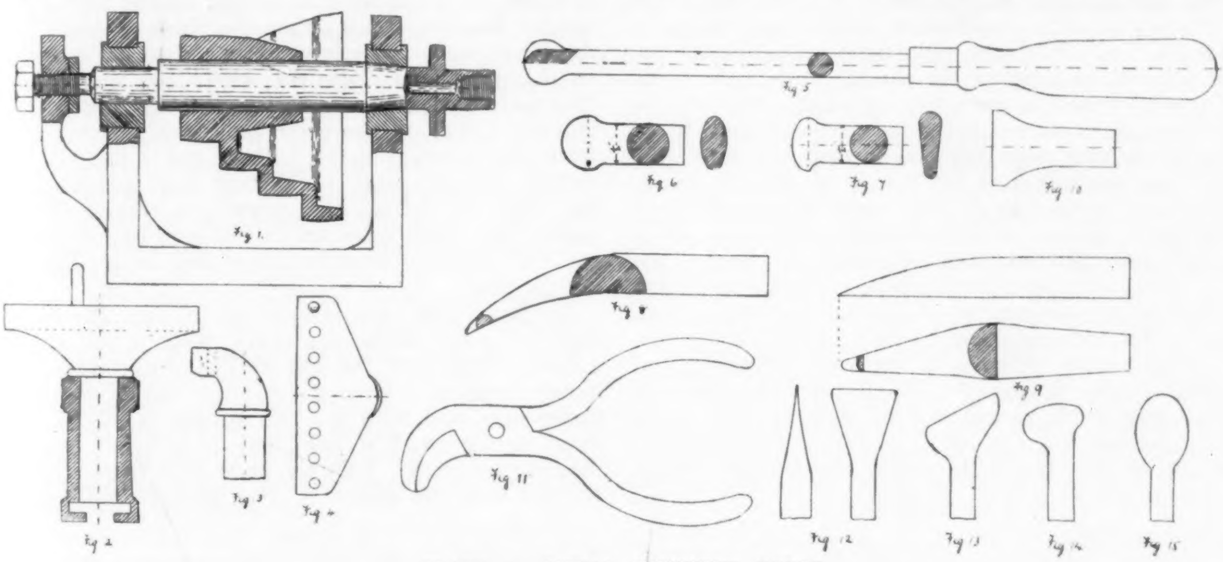


PLATE 1. METAL SPINNER'S TOOLS.

Either wood or metal can be used for the moulds or chucks. Spun articles are not often finished in one process; they generally require annealing, sometimes more than once, before being finished.

The preliminary spinnings are almost always done on wooden chucks roughly turned to shape, but the last or finishing spinning is done on a chuck accurately turned to template. For the preliminary work any odd bits of wood, if large enough, will serve; and, generally speaking, when a chuck has done service for one article it may be altered for another. For cheapness, use common red beach, well seasoned; hornbeam, well seasoned, is best, however. For the finishing chucks, use hornbeam for larger work, and boxwood or metal for smaller. Lignum-vitae is sometimes used. The metal may be cast iron, brass, or bronze. When using boxwood and metal for smaller articles, the screw on a head-stock would necessitate rather large pieces of wood or large castings; therefore a reducing nozzle, (Fig. 16) is used. The central hole is tapped 3/16 in.; in the cross-hole fits a key, (Fig. 17) by the aid of which the chuck can easily be fixed or removed. Boxwood generally meets all requirements of the spinner; when thoroughly well seasoned it will shrink very little, is easily turned, and is naturally smooth and hard.

A very simple spun article is the top of a pepper caster. It consists of the mount fixed on the bottle top, and the perforated lid, which fits tightly on the mount as in Fig. 18. Make the mount first; here the outer sizes of the mouths of the bottles are guides. These vary, but if the difference in diameters is not more than 1/16 in., one chuck will do; choose the largest bottle as a guide. Rough down a bit of good hornbeam in the lathe to a diameter of about 3 in. by 4 in. long. Fix this to the headstock by a screw well up to the collar. Turn it to shape as in Fig. 19, which shows the free end of the hornbeam chuck, the distance from A to B being a shade larger than the outer diameter of the caster mouth or neck. Through the wood is bored a hole large enough to take a 3/16 in. steel rod, threaded at one end to grip in the loose steel plug which fits in the headstock. This rod should be well tempered and securely fixed in a strong file handle, C, by riveting; it serves to keep the metal blank fixed to the chuck. On a piece of No. 25 S. W. G. copper, brass, or German silver sheet, by compasses strike circles with a radius of ¾ in. for the mounts, and mark the center by indenting it by a slight tap on the compass. Cut out the blanks by shears. Punch the central hole by a tool shown in Fig. 20, which is turned from ⅜ in. steel rod 4 in. long, and hardened and tempered. By fixing the point of the punch in the indent on the blank the hole is made quite central. Punch on a thick lump of lead. Slip a suitable bung D on the rod C, Fig. 19, then a metal blank E; put the rod in the hole in the chuck until the plug grips the rod, and put the lathe in motion. In Fig. 19, and in all similar illustrations, either the upper or the left half represents an outline profile, while the lower or right half shows a section. Place the tee-piece in position, its height being such that when the spinning tool is placed on it the knob of the tool is at the centre of the lathe. Dip a rag in oil or in a mixture of oil and tallow, and rub the rotating blank. Hold the tool firmly against the steel peg on the tee-piece, and with the left hand hold a strip of hardwood, roughly wedge-shaped, against the back of the blank, pressing the handle of the spinning tool gently to the right. The metal will give way, the tool describing an arc of a circle with the steel peg as a centre, and the metal slipping between the knob of the tool and the hardwood wedge. When the arc is completed the flat blank will be brought to A, Fig. 21.

*A description, by the same author, of the equipment and tools required was published in our issue for December, 1925, page 485.

On repeating the operation the blank is brought to B, Fig. 21. The ragged edge of the blank is removed by a diamond-pointed tool for brass or German silver, or by a very sharp wood-turner's gouge for copper. Finish the spinning by bringing the metal down close to the chuck, and with the tool shown in Fig. 6 press the metal firmly and smoothly against the wood, to which the blank will cling. Now remove the bung and steel rod. While the lathe is still running, oil the front face of the blank and apply the same tool, placing it at the lowest edge and moving it towards the centre, pressing hard against the chuck, thereby obtaining a sharp angle and finishing the metal. Now with the diamond-pointed tool turn out a little disc of metal, leaving an opening of the same size as the opening of the bottle. In turning, draw the tee-rest a little way from the work and take the tool shown in Figs. 12 or 13. Rest the fingers of the left hand with their inside upwards on the rest; make three fingers a rest for the tool. With the right hand on the handle approach the cutting edge of the turning tool to the metal surface and remove a very fine shaving. The way in which the tool is held secures great delicacy of touch; by holding the cutting edge obliquely against the metal surface, the beginner will soon find that he can remove an excessively fine, continuous shaving which leaves the metal shining like a mirror; a little polishing with fine emery cloth, and with Sheffield lime and blue oil, finishes the mount. As all turning of spun metal is done in the same way, the process will require no further description, but, of course, this turning applies only to brass or German silver; copper must be spun as smooth as possible, and afterwards simply finished by emery cloth and Sheffield lime. To release the mount, set the lathe running, fix a peg in the tee-rest where required, and press the hardwood wedge against the edge of the mount and from the headstock, (see Fig. 22).

it on a beck-iron or on the horn of an anvil, and with a tinman's mallet cut to shape, deal it a series of blows which indent it all over; now anneal as above, but let the metal cool before putting it in pickle. Then, when dry, finish the work. When the metal is home, with the point of a diamond pointed tool near the edge turn through equidistant lines, which serve as ornaments to break the monotony of the surface. With the same tool turn out the bottom, after removing the bung, and screw to complete the ring-shaped part. If the chuck is turned with the least bit of a taper, there will be no difficulty in getting the metal to leave it.

As the flat top has no hole in its centre, the contrivance shown in Fig. 24 is used. In a bung with a central hole a steel plug fits tightly; the plug has a conical hole for the point of the tailstock. When the chuck is turned to shape, place the bung as in Fig. 24 and turn it a shade smaller than the chuck; place the blank centrally between chuck and bung and screw up the tailstock. A spot of oil on the point will make the whole run quite smoothly. The narrow edge is spun half-way down, turned true, and brought home. Remove the bung and proceed with the front, the same as in Fig. 21, to get a flat and smooth surface; turn through equidistant rings and a small central hole, say ⅛ in. in diameter, to receive the turned knob. The small holes are drilled later on. Both the top and the ring are turned and polished before being taken off the chuck.

To join these two, proceed as in Fig. 25; the top is placed in a flat recess on a chuck, the ring put inside, and a bung, similar to the one in Fig. 24, presses the two firmly together. Turn the narrow rim of the top to a knife-edge, and with the tool shown in Fig. 7 bring it down to the ring; if well done, it is hardly possible to perceive the joint. Turn the knob from hard-drawn brass rod, fix it in the central hole of the top, and either rivet

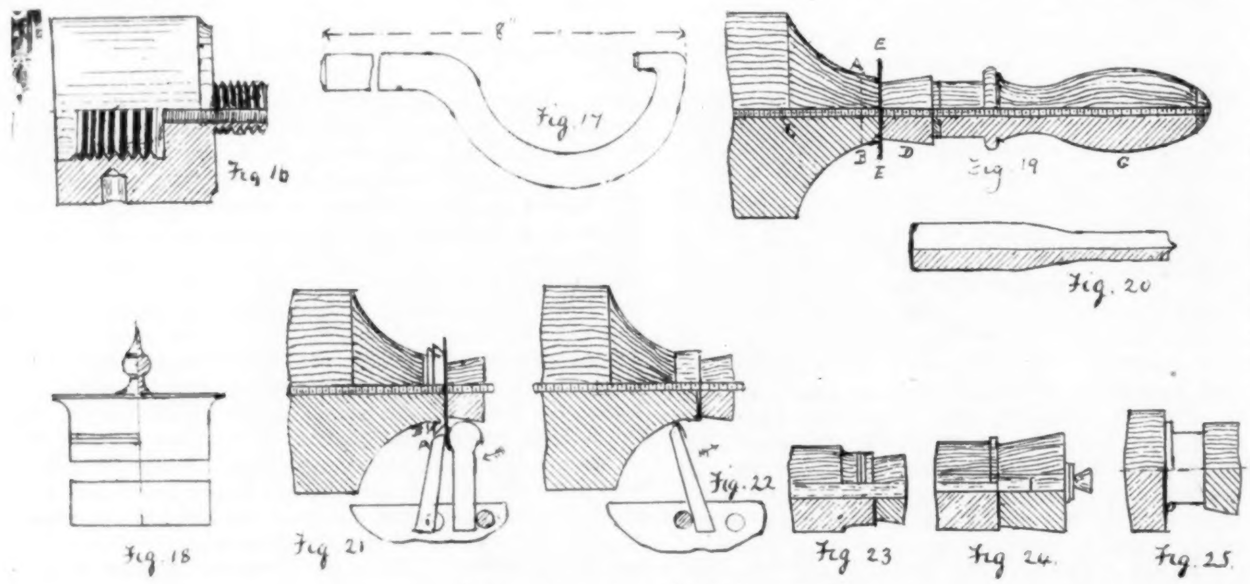


PLATE 2. METAL SPINNING METHODS.

The caster top is made in three pieces; the cylindrical part, the flat cover, and the ornamental button in the centre. The cylindrical part is made after the same fashion as the mount, as shown in Fig. 23. To prevent the metal getting hard and unyielding, and possibly bursting before it is spun home, stop when half-way, remove the metal and anneal it. Thus, for copper, put it on a clear fire or expose it to a blowpipe flame and heat it to a bright red and throw it in pickle—that is, a 5 per cent solution of sulphuric acid, which will dissolve the oxide and leave the metal a fine, dull pink, after washing and scouring. In the case of brass or German silver, previous to annealing, hammer out the tension. Take the hard metal, place

it or fix it with a pellet of soft solder by the aid of a blowpipe. To drill the holes, put the caster top on a piece of wood and press it against a small twist drill running in the lathe. The number of holes and their arrangement is, of course, entirely a matter for the spinner himself. The caster top is now ready, and can be plated or left as it is, according to taste. In the foregoing the easiest operation has been described first, but in practice it is usual to start with the flat top, then to form the ring, and lastly, the mount, because after each part has been finished the chuck can be turned down for the next shape and the whole spun on the same piece of wood without removal from the headstock.

Smelting Secondary Aluminum and Aluminum Alloys

A Series of Articles on the Reclamation of All Forms of Scrap and Used Aluminum and Aluminum Alloys. Part 4. Fluxes for Use in Secondary Smelting*

Written for The Metal Industry by Dr. ROBERT J. ANDERSON, Consulting Metallurgical Engineer

Many different kinds of fluxes have been sugested or patented for use in smelting aluminum and aluminum-alloy scraps and wastes, and a large number have actually been used in practice. At the present time fluxes of one kind or another are generally employed, and a suitable flux is absolutely necessary in running drosses and borings into pig metal, if good recovery is to be obtained. Fluxes are employed for two chief reasons, viz., (1) to ensure separation of dross from the metal, and (2) to prevent oxidation. While it will not be possible in the present article to discuss all the various fluxes that have been sugested as being useful for aluminum work, the principal ones will be considered.

The characteristics of the different fluxes vary markedly depending upon their chemical composition. Broadly, fluxes for secondary aluminum smelting may be divided into four main classes, as follows:

(1) Those which are used principally as liquid (molten) covers to prevent oxidation losses.

(2) Those which dissolve aluminum oxide, Al_2O_3, and induce coalescence of small globules of metal (i.e., the so-called chemical fluxes).

(3) Those which are volatile at or below normal smelting temperatures and which effect separation of dross largely by mechanical action.

(4) Those which are strong oxidizing agents and are used in certain "refining" processes.

Under the first class, there may be mentioned sodium chloride and certain mixtures high in sodium chloride or potassium chloride. Under the second class are included the alkaline fluorides and certain alkaline double fluorides, as well as various complex salt mixtures containing alkaline fluorides and chlorides. Under the third class, are zinc chloride and ammonium chloride, while under the fourth class are included such salts as bichromates, nitrates, and chlorates which yield free oxygen on being heated. Certain salt mixtures are in use which serve as liquid covers to prevent oxidation and at the same time have the power of dissolving aluminum oxide, e.g., the 85:15 sodium chloride-calcium fluoride mixture and sodium chloride-cryolite mixtures.

REQUIREMENTS OF A SMELTING FLUX

In general, a smelting flux for running drosses, borings, fine scraps, and oxidized wastes should have the following characteristics:

(1) The power of dissolving aluminum oxide, dirt, and silicates.

(2) Melting point of about 500°—700° C.

(3) Be non-deliquescent.

(4) Be commercially cheap.

Fluxes fulfilling these requirements have been developed.

The power of a flux for reducing the surface tension of liquid globular particles is also important, and while little information is available on this subject, the question of surface tension should be considered in the selection and development of smelting fluxes. In the case of the haloid salts of the alkali metals, the surface tension decreases with increasing atomic weight of the metal or of the halogen; thus, the value for lithium fluoride is the highest of the series. A consideration of the action of salts on the dispersion of metal fogs shows that a comprehensive knowledge of the interfacial tension between metals and salts is necessary for adequate understanding of the action of fluxes. It is known that the addition of potassium chloride increases the interfacial tension of dispersed lead (lead fog) and causes the fog particles to unite. In the case of aluminum, the interfacial tension between the metal and its oxide is doubtless less than that between the metal and a fluoride flux. A film of oxide on a globule of the metal forms a semi-rigid envelope, and the actual surface tension of the metal is less than if the oxide were not present. The effect of a fluoride flux is to dissolve this oxide thereby causing greater fluidity.

The question of density of a flux is important. If used as a liquid cover, the density should be less than that of liquid aluminum, and a flux having density of less than 2.1 fulfills all requirements. If the flux should make intimate contact with particles of fine scrap, it should have density about the same as that of the liquid metal so that it will not rise at once to the surface of the bath. In using such a flux, the melt must subsequently be treated with a volatile flux in order to ensure removal of particles of the first flux from the melt.

DISCUSSION OF THE FOUR CLASSES OF FLUXES.

Referring first to fluxing covers, these usually consist of inexpensive salts which in the molten condition overlie the bath of metal and serve to prevent, or at least considerably reduce, oxidation. When light scrap is melted, (e.g., borings), there is a large surface area of metal exposed to the furnace atmosphere, and it is necessary, for economical recovery, to protect the surfaces of the small pieces from oxidation so far as possible. Hence, the reverberatory smelting of light scraps under a blanket of flux is good practice. Fluxing covers are not generally used in crucible or iron-pot practice. The fluxing cover may be of such composition that it will absorb or dissolve aluminum oxide, dirt, and other foreign matter in the scrap being smelted, and hence serves in cleansing the bath. At the present time, the composition of the fluxing cover is made such that it will dissolve aluminum oxide, dirt, etc., and in addition to protecting the melt from oxidation, has a chemical action in taking up foreign matter. Sodium chloride is the usual fluxing cover employed to prevent oxidation, but covers which will dissolve aluminum oxide have been developed. Such covers include

*Parts 1, 2 and 3 were published in our issues of January, 1925, September, 1925, and February, 1926, respectively.

the 85:15 sodium chloride-calcium fluoride mixture; sodium chloride-cryolite mixtures; sodium chloride-calcium fluoride-cryolite mixtures; calcium chloride and various mixtures high in calcium chloride. The percentage of the fluoride salt added to a sodium chloride cover depends upon the character of the scrap or waste being smelted.

Regarding fluxes which dissolve aluminum oxide, these are usually referred to as fluoride or chemical fluxes because they contain fluoride salts which dissolve aluminum oxide by chemical action. These fluxes consist usually of mixtures of the halogen compounds of the alkali metals (the fluorides and chlorides of potassium, sodium, and lithium) and of the alkaline-earth metals. Preferably, a fluoride flux should have a lower melting point than aluminum, dissolve aluminum oxide readily, contain no metal which is easily reduced from its salt combination by aluminum, and not be readily volatile. Fluoride fluxes were developed by Schoop through experiments on welding aluminum where it is desired to use a flux having a positive solvent action on aluminum oxide. Mixtures of salts corresponding to welding-flux compositions are generally too expensive for use in secondary aluminum smelting, and hence cheaper fluxes have been developed, e.g., the 85:15 sodium chloride-calcium fluoride mixture and the sodium chloride-cryolite mixtures. As indicated, the fluoride fluxes dissolve aluminum oxide, and they may also liberate fluorine which attacks silicates and dirt. The setting free of gases by the decomposition of these fluxes, e.g., fluorine or chlorine, gives rise to upward currents in a bath of metal and thus assists in the removal of foreign entrained matter. The chemical action of a complex fluoride flux may be indicated in the case of a mixture of lithium chloride, potassium chloride, potassium bisulphate, and potassium fluoride. Under the effects of heat, the potassium fluoride may interact with the potassium bisulphate, yielding hydrofluoric acid, and this acid attacks aluminum oxide forming aluminum fluoride. The aluminum fluoride combines with the excess of potassium fluoride in the flux, forming potassium aluminum fluoride, and this double compound dissolves additional amounts of aluminum oxide. In this flux, the lithium chloride and potassium chloride are present to give low melting point.

In the case of volatile fluxes, so-called because they volatilize or dissociate below ordinary smelting temperatures, the fluxing action is doubtless largely mechanical but in part chemical. The two fluxes which have been used most in secondary work are zinc chloride and ammonium chloride. While these salts have been and are employed as the chief fluxes in certain smelting processes, e.g., zinc chloride in the dry process for smelting borings, they are useful chiefly for removing suspended matter from melts before pouring. Zinc chloride is the better flux of the two. When added to a melt, zinc chloride volatilizes and also sets free chlorine. Upward currents are caused in the metal, thus causing suspended matter to rise to the top of the melt and join with surface scum. The chlorine set free attacks dirt and silicates as well as aluminum oxide. Zinc chloride has a powerful effect in detaching oxide from metal and yields a dry dross which is readily skimmed.

Regarding oxidizing fluxes; these are not used to any extent in American practice, but have been tried both here and abroad, particularly for running aluminum scrap into pig metal to be used for rolling or drawing. These fluxes include the bichromates of sodium, potassium, and ammonium, and certain mixtures of these salts, as well as the chlorates, nitrates, and permanganates of several metals. Other salts have also been tried, the principal requirement being that the salt should yield free oxygen on being heated to 600°-700° C. Salts which are readily reduced to metal by aluminum, giving rise to metals which would harmfully affect the mechanical properties of the resultant metal, should not be used, e.g., the alkali nitrates. The object of using so-called refining or oxidizing fluxes is to oxidize impurities which then rise to the top and are slagged off. These fluxes have not found any extended use as their effects are not well understood or known. It is claimed that burnt aluminum can be restored to its original condition by treating with 2 oz. potassium nitrate per 100 lbs. of metal.

LIST OF FLUXES.

The principal fluxes used in aluminum and alloy smelting practice have been discussed briefly above when considering the four main classes of fluxes. In addition, a list of some of the fluxes which have been suggested may be given. Fluxes have been discussed at length by Gillett and James[1] and by the writer[2]. In the list given below, additional information is included.

Aluminum Chloride:—Anhydrous aluminum chloride, $AlCl_3$, has been recommended for use as a flux in secondary smelting. It melts at 190° C. and boils at 183° C. This flux has a mechanical action largely, being useful in removing suspended foreign matter from melts. It has been employed only slightly in secondary work.

Binary Salt Mixtures:—Many binary mixtures of salts have been suggested or used. There are a number of possible mixtures of alkali and alkaline-earth chlorides and fluorides having relatively low melting points which might be employed as liquid covers or fluxes. Salts of some metals which are reducible by aluminum are not desirable. Among other fluxes may be mentioned mixtures of calcium chloride and potassium chloride. The melting point of the two lowest melting mixtures of calcium chloride and potassium chloride (one being 85:15 calcium chloride-potassium chloride and the other 40:60 calcium chloride-potassium chloride) is 630° C.A mixture of 85:15 calcium chloride-calcium fluoride has been tried as a flux; this melts at 655° C. Another mixture tried is 36:64 sodium fluoride-aluminum fluoride, melting at 685° C., and another is 60:40 potassium chloride-potassium fluoride melting at 610° C. Low melting point mixtures are obtainable in the potassium chloride- lithium chloride system and in the sodium chloride-lithium chloride system. As previously mentioned, the 85:15 sodium chloride-calcium fluoride flux is used considerably in practice; this is a fluoride flux which is commercially cheap. It melts at 785° C. and s very fluid at 800° C. Another flux is the 88:12 sodium chloride-sodium fluoride mixture. A mixture of 85 parts commercial calcium chloride (containing some sodium chloride) and 15 parts calcium fluoride freezes at about 600° C., and substitution of 5 and 10 per cent of sodium chloride to this mixture in place of equivalent weights of calcium chloride gives mixtures freezing at about 675° and 680° C. These and other mixtures high in calcium chloride have been tried in practice, but they are generally very viscous at temperatures high above their melting points. Other binary salt mixtures include 60:40 potassium chloride-cryolite (used as a liquid cover), cryolite-sodium fluoride (various percentages) and mixtures of sodium chloride and borax. According to a recent patent[3], zinc chloride (or ammonium chloride) and sodium chloride are combined in the smelting process; in running fine scrap, zinc chloride is first charged after the scrap has been added to a bath of metal, and then sodium chloride is charged to serve as a cover.

Borax:—Borax has been suggested and actually used slightly as a flux in secondary aluminum smelting.

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[1] H. W. Gillett and G. M. James, Melting aluminum chips, U. S. Bureau of Mines Bull. 108, August, 1916.

[2] R. J. Anderson, The metallurgy of aluminum and aluminum alloys. Henry Carey Baird and Co., New York, 1925.

[3] U. S. Pat. No. 1,550,192, August 18, 1925.

According to a patent, it dissolves aluminum oxide. It it known that if aluminum is melted under a layer of borax, aluminum is dissolved and an aluminum borate formed. Borax melts at 650° C.

Calcium Chloride:—As mentioned above, mixtures high in calcium chloride have been used, and calcium chloride alone has also been tried. Liquid (molten) calcium chloride can dissolve 3 per cent of silica at 820° C., 5.5 per cent at 900° C., and 7.5 per cent at 950° C. Its specific gravity at 800° C. is 2.05.

Complex Salt Mixtures:—A great many complex salt mixtures have been suggested as fluxes. While it is not necessary to mention all the various mixtures here, the tendencies in composition may be indicated by citing a few of them. One flux that has been recommended consists of a mixture of 10 parts sodium carbonate, 2 parts potassium carbonate, 2 parts cryolite, and 1 part borax. This is to be used in the proportion of 1.5 lbs. of flux to 100 lbs. of borings. The mixture 56:28:16 aluminum fluoride-cryolite-calcium fluoride has been suggested. Another flux contains 30-40 per cent sodium chloride, 40-50 per cent calcium chloride, 5-15 per cent potassium sulphate, and 5-15 per cent cryolite. Another contains 60 per cent potassium chloride, 20 per cent lithium fluoride, 12 per cent sodium chloride, and 8 per cent potassium sulphate. A similar mixture has been used but cryolite is substituted for the potassium sulphate. Another flux consists of an addition of the fluorides of calcium, potassium, or boron to a mixture of chlorides of the alkali metals. A flux containing equal parts of lithium chloride, potassium chloride, and sodium fluoride (or potassium fluoride) has been tried. The complex fluxes have been used in practice both as liquid covers (e.g., sodium chloride-calcium fluoride-cryolite) to prevent oxidation and as dissolving agents to take up aluminum oxide.

Cryolite:—Cryolite (sodium aluminum fluoride) has been used alone in secondary smelting, but its melting point is too high, being 995° C. Various salts may be added to lower the melting point. In practice cryolite is generally used in admixture with other salts and makes up a relatively small percentage of the flux mixture.

Degasifiers:—Poor mechanical properties of both primary anud secondary aluminum are often traceable to dissolved gases, and hence it is often desired to degasify melts. No flux is available which serves as an effective degasifier, but the mechanical properties of gassed metal may be improved in some cases by treating the melt with nitrogen. Allowing a melt to stand for a long time in the furnace at moderate temperature sometimes is helpful.

Deoxidizers:—Since one of the objects of a flux in secondary work is to remove aluminum oxide from the melt, various so-called deoxidizers have been suggested and used for the purpose of divorcing oxygen from the aluminum oxide, thus reducing it to metal, the oxygen being supposed to combine with the deoxidizing substance and being removed as a slag. So far, no actual deoxidizer which gives positive results and which works in practice has been brought out. Aluminum oxide is removed from melts by the use of fluoride fluxes which actually dissolve the oxide or by volatile fluxes which effect mechanical separation.

Fluorspar:—Fluorspar (calcium fluoride) is an excellent solvent for aluminum oxide, and it has been employed alone as well as in admixture with other salts (e.g., sodium chloride) as an aluminum smelting flux. Calcium fluoride is also a good solvent for silicates. The dirt in borings consists largely of silica and silicates.

Metallic Fluorides:—In addition to fluorspar, certain other metallic fluorides, notably alkaline and alkaline-earth fluorides, are solvents for aluminum oxide. Normally such metallic fluorides are not used alone as fluxes, but rather in combination with other salts to form complex mixtures. Fluorides of copper, nickel, or zinc mixed with alkali fluorides have been patented. Liquid aluminum will reduce the fluorides of the heavy metals (e.g., the fluorides of copper, nickel, or zinc), the reduced metals alloying with the excess aluminum and forming an equivalent amount of alumium fluoride. The mixture of aluminum fluoride and alkaline fluorides acts to dissolve aluminum oxide. A mixture of zinc chloride and sodium fluoride has been patented for use as a flux.

Regenerators:—It has been claimed that burnt, gassed, or otherwise impaired aluminum or alloys can have the original mechanical properties restored by treatment with a flux or by the addition of certain metals. Hence, substances used for this purpose have been referred to as "regenerators." Thus, titanium, calcium, and calcium aluminum silicide have been said to act in this manner. In a recent patent[4], it is said that small quantities of silicon, antimony, or calcium, should be added to melts of aluminum scrap to restore the original properties. Treatment with alkali nitrates has also been suggested. These substances should be used with caution as they may do more harm than good.

Sodium Chloride:—This salt, as previously mentioned, is used as a fluxing cover, either alone or in admixture with other salts, and it has also been mixed with borings in the puddling process.

Welding Fluxes:—The employment of aluminum welding fluxes in secondary smelting is metallurgically sound since these fluxes have a positive solvent action for aluminum oxide. However, their use is prohibitively expensive in smelting owing to the relatively high cost.

[4] French Pat. No. 570,114, January 12, 1924.

Hardness of Metals

SCLEROSCOPE HARDNESS OF COMMERCIAL ALLOYS AT VARIOUS TEMPERATURES

Temp. Deg.	85-5-5-5 Steam Metal	88-10-2	Nickel Silver Alloy	Silicon Bronze	Machine Steel	Monel Metal	30% Nickel Steel	Cold Rolled Steel
70°	20	27	46	45	47	48	45	52
200°	19	24	45	41	44	46	41	48
300°	17	21	44	39	37	43	35	43
400°	16	19	44	38	32	42	29	40
500°	15	19	43	37	28	39	27	28
600°	14	19	44	36	27	38	26	37
700°	14	15	43	35	26	35	25	35
800°	13	15	42	33	25	32	25	35

Each point represents an average of 5 tests.

E. G. Jarvis.

Copper in Lead Base Babbitt

I am of the opinion that copper in a lead base metal, when over ½% is detrimental to the babbitt. First it causes the metal to become very brittle, and in thin linings, the tendency is to crack. We have done considerable work along this line and have found a mixture of 78% lead, 14% antimony and 8% tin, with copper, if any, not over .25, to be the equal of genuine babbitt, in most cases where there is not too much pounding. It is not only cheaper, but its great plasticity and anti-fraction properties make it last longer and run cooler. It has a Brinnell hardness of 25 to 30. Unless the metal gets brittle we have a metal the equal of genuine babbit.

Copper in a lead base metal never in our experience, or as far as we would learn, produced a better bearing metal than one free from copper.—W. J. Reardon.

Welding Copper Tubes

Written for The Metal Industry by P. BLAIR, Mechanical Editor

The best method to follow in welding copper tubes is termed autogenous welding. The temperature required is obtained by the combustion of a mixture of gases such as oxygen and hydrogen. One or both of these gases may be under pressure. The gases are mixed in the nozzle of the torch prior to combustion. Ordinarily the weld is formed by fusing in additional material between the surfaces of the joint. This material is in the form of a rod or wire and may or may not be of the same composition as the material being welded.

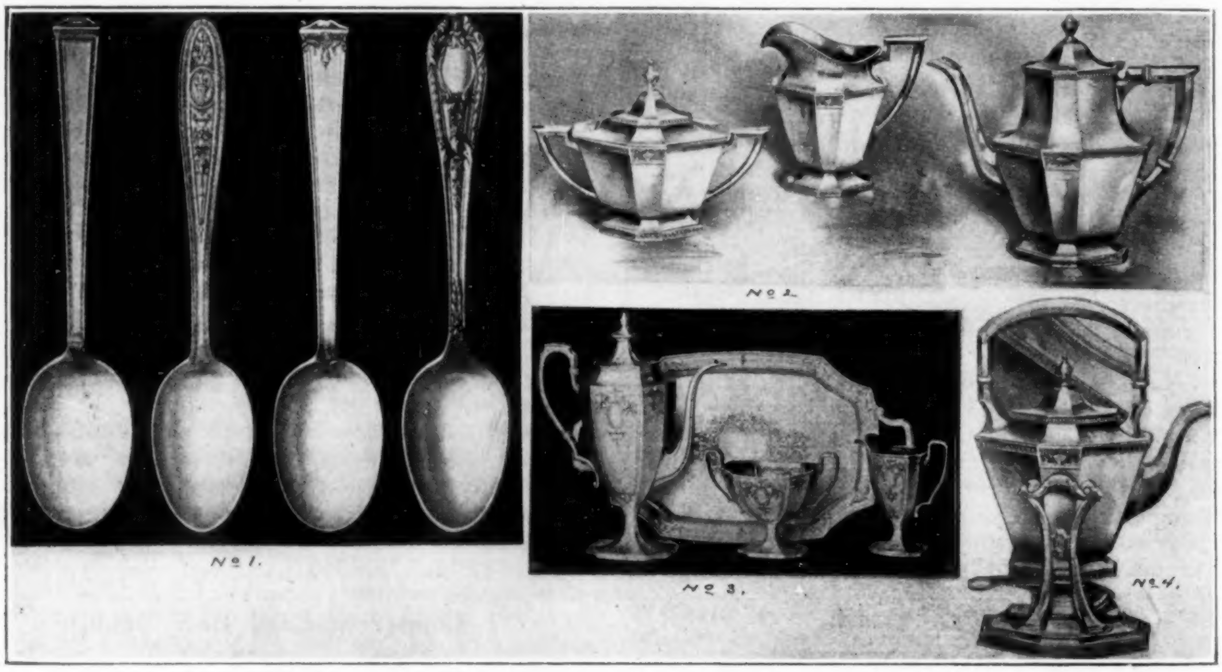
To weld copper, use the same kind of flame as for steel, but a much larger tip for corresponding dimensions because of the great radiating property of copper. Preheating is necessary when a large piece of copper is to be welded, as otherwise so much heat from the torch will be dissipated by radiation that little will be left for fusing the metal.

Copper will weld at about 1,930 deg. F., hence the flame need not have so high a temperature as for steel and it must not be concentrated on so small a surface. On account of the radiation, however, the total quantity of heat must be greater. Welded copper has the strength of cast copper, but can be made more tenacious by subsequent hammering.

The radiation from copper can be considerably lessened by covering it with asbestos sheets while heating. The surfaces should be thoroughly fused before adding metal from the welding stick and the latter should be held to or in close contact with the surface. The heat is then radiated from the welding rod to the work, whereas if the metal were allowed to drop through the flame it might be burned to an injurious extent. When welding two parts together, it is important not to heat one more than the other, because the hottest piece will expand most, and the weld may crack in cooling as the result of uneven contraction. When the weld is completed, it is advisable to pass the torch over it so that all parts will cool from a nearly uniform temperature.

Silverware Designs

Written for The Metal Industry by A. F. SAUNDERS, East Syracuse, N. Y.



SILVERWARE PATTERNS, 1910-1925.

No. 1. Four of the latest spoon patterns, two of which are of classic design, one in the English Georgian period of the time of Wedgewood, the other portrays the more elaborate style of the Italian Renaissance.

No. 2. A Sterling silver tea service of 1922 following the vogue for period styles. Its fluted Colonial form and classic Adam decoration form a most pleasing design.

No. 3. Coffee service in Sterling silver 1923 design showing influence of the English Middle Georgian period. This set is a good example of the development of die work in the making of silver. All of the body work and the tray are die formed; the decoration, hand work in flat chasing.

No. 4. Hot water kettle, part of "Adam" tea service shown above. Another example showing the great improvement made in design since the days of the tea kettle shown on plate 3 in the article published in August, 1925, page 325.

Other articles on silverware by the same author were published in our issues for April and August, 1925, and March, 1926.—ED.

Electrochemical Society Meeting

Abstracts of Papers on Metals and Electrodeposition Read in Chicago, Ill., April 22-24, 1926

HYDROGEN ION CONTROL OF NICKEL-PLATING BATHS WITH THE QUINHYDRONE ELECTRODE

By Henry C. Parker and Willard N. Greet

The quinhydrone electrode has been found to give reliable measurements of the hydrogen ion concentration of nickel-plating baths. Its use results in greater accuracy, and in a considerable simplification of technique over any other method now in use. An exceedingly easy and accurate method has been developed for the control of the acidity of nickel-plating baths by making use of this electrode. The measurements were compared with the results obtained by the use of commercial dyes and colorimetric standards. The average error in the latter method was found to be $\pm$ 0.2 pH.

NOTE ON THE PROTECTION OF IRON BY CADMIUM

By Henry S. Rawdon

Recent writers on electrochemistry, with a few outstanding exceptions, assign values to the electrode potentials of zinc, cadmium and iron so that iron stands between the other two in the series. A conclusion which may be based upon this arrangement that a coating of cadmium on iron would not protect electrochemcally in the way that a zinc coating on iron will, is not in agreement with observations made upon such coatings.

The article summarizes the results of some simple qualitative experiments in which specimens of steel and of iron, in each of which a plug of another metal was inserted, were immersed in dilute sodium chloride solution. Zinc and cadmium behaved *alike* in preventing the corrosive attack of the iron. The anodic behavior of each of the two with respect to iron under the conditions used was also clearly revealed by the etching action which took place on the surface of the inserted plugs, as a result of which the crystalline structure of the cadmium and of the zinc were clearly revealed.

No conclusion regarding the single electrode potentials of the metals used, that is, their relative position in the series, seems warranted, since a possible explanation of the results obtained, on the basis of the relative dissociation of the different metal salts involved, can be shown to be valid from theoretical considerations. Results are also given for the other common metals, when in contact with iron and immersed in a dilute sodium chloride solution.

ELECTROCHEMICAL AND X-RAY SUDIES OF LEAD DEPOSITS

By Per K. Frölich, George L. Clark and Robert H. Aborn

Lead electrodeposits from acetate, nitrate, perchlorate fluoborate and fluosilicate electrolytes, in the presence and absence of free acid and of gelatine as an addition agent, are studied from the standpoint of potentials and of the crystalline structure as revealed by x-ray analysis.

From a practical standpoint the deposit from perchlorate in the presence of excess acid and of gelatine is best, with maximum cathodic polarization, minimum grain size, absence of dendrites and considerable evidence of preferred orientation of the crystal grains for a given current density.

The grain size increases with the thickness of the deposit; similarly the outer layers show less preferred orientation than the innermost.

The effect of the base metal is brought out through experiments with iron and platinum cathodes with and without a coating of beeswax, confirming the previous observations by Clark and Frölich on the deposition of nickel on aluminum and platinum.

From the course of the current density-potential curves the conclusion is drawn that the resistance met with in cathodic formation of crystals is small for lead.

The effect of gelatine is to decrease the crystal growth by securing an even distribution of the metal over the entire surface of the cathode, as has been manifested in previous papers.

ELECTRODEPOSITION OF ZINC FROM ELECTROLYTES CONTAINING GELATINE AND ALUMINUM SULFATE

By Per K. Frölich

Electrodeposition of zinc has been studied for various types of acid electrolytes, with and without gelatine, and with the hydrogen ion concentration of the solutions as the only variable. The data obtained demonstrate that there is present a thin film of electrolyte on the surface of the cathode; that the hydrogen ion concentration on the inner surface of this film next the cathode is below that in the main body of the solution, corresponding to a pH value above five; and that gelatine added to the electrolyte accumulates in this film. While the gelatine in the main body of the electrolyte and in the outer layers of the cathodic film of electrolyte is positively charged and basic in character, on the inner surface of the cathode film, it is negatively charged and acidic in character. This is due to its inversion in passing through the isoelectric point, pH = 4.7, thus behaving totally unlike gelatine in copper deposition. Finally, the data indicate that aluminum sulfate as an addition agent has an effect similar to that of gelatin, owing to the precipitation at the high pH of the cathode film of aluminum hydroxide, probably in the collodial state. The data presented are in complete accord with the previously accepted concepts of electrolytic deposition of metals, and offer an explanation of the marked difference in the behavior of gelatine and aluminum salts as addition agents in the deposition of copper on the one hand and zinc on the other.

THE CONSTITUTION OF THE ALLOYS Al-Mg FROM 32 to 48 PER CENT Mg.

By Thomas Halstead and Donald P. Smith

Alloys of Al and Mg ranging from 32 to 48 per cent Mg were carefully prepared in an especially designed apparatus. This apparatus involves a number of radical departures, and makes it possible to prepare alloys of these two metals which are free from impurities, such as are obtained when casting the light metals under ordinary conditions. The thermo-electromotive force and the temperature coefficient of resistance of a series of pure Al-Mg alloys were then determined. Results indicate that there exist two regions of solid solution, in place of the single β field found by earlier investigators.

Metallizing Non-Metallic Objects

By E. SCHOR, New York*

The art of metallizing is a subject worth while to be taken up by the platers of today. Many articles could be manufactured by metallizing non-metallic objects by combining the art of electroplating with the art of sculpture, thereby making it possible to produce copies of the finest plastic art at a very low cost. When finished, these copies have the appearance and wearing qualities of solid bronze.

In preparing non-metallic objects for metallizing it is necessary to divide them into two classes:

Class I—Those that are very porous, such as plaster of paris, terra cotta, cork, wood, etc.

Class II.—Those that are less porous, such as leather, bone, fruits, flowers, close-grain wood, glass and porcelain.

PREPARING CLASS I

The first operation in preparing objects of Class I is to make them thoroughly dry. After this is done they are introduced into an acid-proof composition. Unless this is done the solution will penetrate the object and spoil the entire operation.

To prevent this the objects are soaked in the following acid proof composition:

ACID-PROOF COMPOSITION

Carnauba (Brazilian) Wax	3 lbs.
Paraffine Wax	7 lbs.

The melting point of the composition is about 235° F. The object must remain entirely covered for about 30 minutes. Then it should be taken out and allowed to dry. After the object is dry it is given a thin coat of shellac. Then it is set aside to dry. When thoroughly dried the object is sprayed with two coats of the following mixture:

Bronzing liquid	1-3 pt.
Lacquer thinner	2-3 pt.
Copper plating bronze powder	2½ oz.

After this is done the object is allowed to dry between 4 and 5 hours in the air. After this time the object is ready for the copper-depositing bath.

PREPARING CLASS II.

In preparing the objects that are not very porous all that is necessary is to give them two coats of shellac, and after drying, spray the object with the same bronzing liquid formula as in Class I. After the object is dried it is ready for the copper-depositing bath.

THE COPPER SOLUTION

The nature of the copper solution is far more important that anyone would first suppose it to be. The ordinary acid copper solution used for plating is far too strong for metallizing purposes. The best solution I have used for this class of work is as follows:

Sulphate of copper	24 ozs.
Sulphuric acid	6 ozs.
Water	1 gal.

and 1 lb. of oxalic acid to every 100 gallons of solution.

The solution is kept in an agitated condition by means of air, as the agitation is very important. An agitated solution produces a more even deposit of copper and a better quality, preventing the forming of gas bubbles and streaks on the work which very often cause the plater a great deal of trouble, but which is seldom or never seen in an agitated bath; also a higher current may be used, resulting in an increased rate of deposition. When the work is put in the bath it is started on 2 volts and continued for about three hours. After this the work has to be taken out and looked over to see if there are any spots not covered. If there are any spots uncovered it has to be touched up with the paste of copper bronze powder and bronzing liquid. After that the voltage should be reduced to 1 volt and run at this rate from 24 to 36 hours. The amperage would have to be determined from the area of the cathode, about 18 amperes per square foot. After the given time the work is taken out, polished, buffed and finished in any desired finish.

*From the Monthly Review, October, 1925.

Gun Metal on Stove Tops

Q.—Can you give me a formula or solution for producing a gun metal finish on cast iron such as stove tops?

A.—There are several methods in vogue for the production of a gun metal finish on stove tops, etc., but the finish produced by heat is the most substantial. The method is as follows:

In a cast iron or welded steel tank or pot, heat commercial sodium nitrate to 900° F. To every pound of the nitrate add 2 ozs. black oxide of manganese. The stove tops should be clean and perfectly dry before immersing in the molten bath and it is advisable to pre-heat the stove parts to about 400° F. before immersing. The gun metal finish is produced in a few minutes at the 900 degree temperature. The stove parts should then be immersed in cold water to rinse off the adhering sodium nitrate and while the parts are still hot, they should be wiped with boiled linseed oil to which has been added black nigrosine to produce a black toned oil. This material must be oil soluble. There are three kinds, alcohol, water, and oil soluble black nigrosines. The oil so treated and applied will give protection to the finished stove parts and is the only material that need be applied afterwards to the stove parts in use.

Another method is almost the same as the first. The materials to be used are equal portions by weight of sodium nitrate and sodium nitrite. This mixture will melt at a low temperature, 450° to 500° F., and can be used at 700° F.—C. H. PROCTOR.

Stamping Lead Washers

Q.—I am taking the liberty of writing to inquire if you can furnish me with information pertainng to the manufacture of lead washers, samples of whch I herewith enclose.

The trouble I am having at the present time is, the loss in manufacturing these washers. They are stamped out of lead ribbon 2¼" and 4½" wide. Out of 500 lbs. of the 4½" ribbon I am able to get only 100 lbs. of washers. What I should like to find out is, if there is a more economical way of manufacturing these washers.

A.—As nearly as we can figure the gauge of your ribbon, it should weigh about 12 lbs. per sq. ft., or 4½" wide and 32" long should be about a sq. ft. You should get about 576 washers per sq. ft. from 12 lbs. of material. A good clean cutting die will cut 9 washers in a row.

There is no other way of making these washers economically. The fact that they can be made in a power press eliminates all possible chance of die casting or molding. A multiple die with the punches set close together is the cleanest and best possible method.—W. L. ABATE.

A Simple Method for Measuring Polarization and Resistivity

A Paper Presented at the Forty-ninth General Meeting of the American Electro-chemical Society Held in Chicago, Ill., April 22, 23 and 24, 1926[1]

By H. E. HARING

Associate Chemist, Bureau of Standards, Washington D. C.

A single apparatus and method are described by which both resistivity and polarization during electrolysis can be measured, with an accuracy approaching that of the more elaborate conventional methods. The new method was found to be reliable in copper, nickel and silver plating solutions, and is therefore probably generally applicable in electrodeposition. A new method for the graphic analysis of the voltage used in electrolysis is also described.

It has become recognized that the results of an electrolysis are largely dependent upon only two factors, electrolyte resistivity and electrode polarization. Thus it has been shown that in electrodeposition these two quantities influence the current and metal distribution on a cathode, that is, the throwing power[2] and the structure of deposited metals.[3] In addition, polarization largely determines the electrode efficiencies and the purity of the products of electrolysis.

Measurements of resistivity are frequently used for industrial control, and compact, relatively simple apparatus has been designed for the purpose. Owing, however, to the more complex equipment required for polarization measurements, and the skill and experience needed to use it, polarization measurements are rarely, if ever, made for plant control, and, in some cases at least, no clear distinction is made between the effects of polarization and of resistivity.

The purpose of this paper is to describe a new and simple method by which both solution resistivity and electrode polarization during electrodeposition can be measured, and to show that the results are sufficiently accurate to meet most present needs for such information.

GENERAL PRINCIPLES

The **resistivity** of a solution is usually defined as the resistance in ohms of a portion of the solution having a uniform cross section of one square centimeter, and a length of one centimeter. This unit is known as the "ohm-centimeter," although the values are often referred to as "ohms per centimeter cube."

Polarization at an electrode, for a given current density, may be defined as the departure of the potential of that electrode from its **static** or equilibrium potential in the given solution, brought about by the passage of the current. In other words, it is the difference between the static potential, that is, at zero current density, and the **dynamic** potential, that is, at the specified current density. If the electrode potential becomes more negative (less noble) the polarization is cathodic, if more positive (more noble) it is **anodic.**

The relation between resistivity and polarization during electrolysis is clarified if we recall the fact that the total potential drop in any electrolytic cell, with the anode and cathode both consisting of the metal to be deposited, is equal to the sum of (a) the potential required to overcome resistance, that is, the IR drop, which is a function of the resistivity of the solution, the dimensions of the cell and electrodes, and the current; (b) the anode polarization, and (c) the cathode polarization.

If instead of being soluble and similar to the metal to be deposited the anode is unattacked, and oxygen is evolved upon it, the total potential drop in the cell includes also the "decomposition potential," that is, the difference between the static potentials in that solution of the products of electrolysis.

FIG. 1. A SIMPLE DEVICE FOR MEASURING POLARIZATION. The rod consists of the metal being deposited and the tube contains the solution used in the bath.

To measure polarization, all that is necessary is to determine the difference in single potential of an electrode when current is and is not flowing. In the conventional methods this is usually accomplished by comparing potentials of the electrode in questions under these two conditions, with that of a reference electrode such as the calomel half-cell, which is assumed to be non-polariable for the very small currents that may be used during the potentiometer adjustment.

It is, however, simpler in principle to use the statis potential of the metal itself in the given solution as the basis of reference. An arrangement embodying this principle is shown in Fig. 1. The glass tube with capillary extension is filled with the same solution as that undergoing electrolysis; the rod dipping into the tube consists of the metal involved. The e. m. f. of the cell, consisting of the unpolarized metal rod and the electrode under study, is then equal to the polarization of the latter. This system involves no liquid junctions; consequently errors due to contact potentials, which might arise when the calomel or similar half-cells are used, are eliminated.

Such an electrode when used for potentiometric measurements of polarization yields results of the accuracy usually required. Owing to the small area of the metal rod, however, its potential may change slightly through polarization produced by any small current that flows during the measurement. This source of error may be reduced by placing a high resistance in the half-cell circuit, or by increasing the area of the metal in it, for example, by the use of a gauze spiral. There is, however, one other source of error inherent in all reference electrodes involving contact of a capillary tip with the electrode undergoing examination, that is, the introduction of a small but uncertain IR drop between the tip and the face of the electrode. In principle this may be eliminated by having the reference electrode at a known distance from the cathode, and measuring and correcting for the IR drop in this distance.

The above principles are incorporated in the apparatus shown in Fig. 2. The essential features of this apparatus are as follows: The electrolytic cell has any convenient length and a uniform cross-section. At opposite ends of

[1] Published by permission of the Director, U. S. Bureau of Standards.

[2] H. E. Haring and W. Blum, Trans. Am. Electrochem. Soc., 44, 313 (1923).

[3] W. Blum and H. S. Rawdon, Trans. Am. Electrochem. Soc., 44, 397 (1923).

the cell and perpendicular to its longitudinal axis are located plane parallel electrodes consisting of or plated with the metal to be deposited. These electrodes which serve as anode and cathode respectively have each an area equal to the cross-section of the solution. This last condition insures a uniform current distribution throughout the cell and on the electrodes, an essential requirement for significant measurements of polarization and resistivity. Interposed between anode and cathode and parallel to them are two wire gauzes, consisting of or plated with the metal

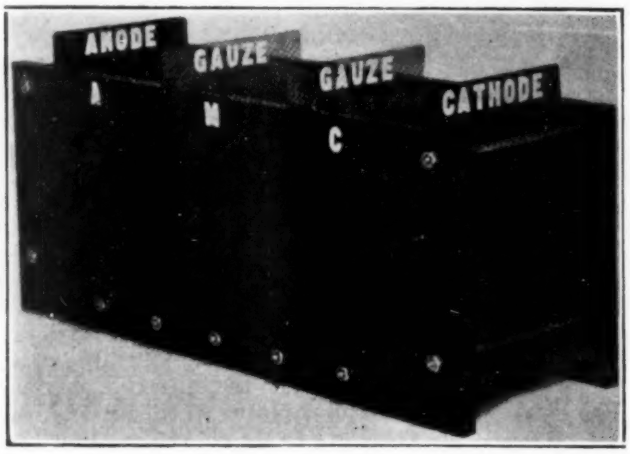


FIG. 2. CELL DEVELOPED FOR POLARIZATION AND RESISTIVITY MEASUREMENTS

involved, which also cover the cross-section of the solution. For convenience, the gauzes should be so spaced that the cell is divided into three equal compartments, which may conveniently be designated as the anode (A), middle (M), and cathode (C) compartments.

The apparatus (Fig. 2) used for the experiments which follow consists of a rectangular hard rubber tank with vertical slots in the sides for spacing the four electrodes. As illustrated, the tank is divided into three compartments, each containing a one decimeter cube of solution. Additional slots are provided for spacing the electrodes 5 cm. apart. The latter arrangement, in which only one-half of the tank is utilized is more convenient for solutions of relatively high resistivity.

If the intermediate electrodes in this tank were solid sheet metal, and a current was passed through the solution, the side of each sheet toward the anode would behave as a cathode, that is, metal would be deposited upon it and it would be cathodically polarized; while the other side would behave as an anode. (This principle is used in series copper refining.) The cathode polarization would be caused by a depletion of metal ions in the adjacent solution, and the anodic polarization on the other side would arise from an increase in the metal ion concentraton.

If, however, as shown in Fig. 2, the intermediate electrodes consist of gauze, there is no appreciable polarization on either side, because of a continuous mixing of the solution from the two sides. In short, these gauzes constitute non-polarized electrodes. To be effective it is necessary only that the holes be large enough to facilitate convection and mixing of the solution, and that the metal area be large enough to prevent appreciable polarization by any small current that may be drawn from the gauze during the potential measurement. For practical purposes 20-mesh (8-mesh per cm.) gauze meets these requirements.

If then these intermediate electrodes are unpolarized, the potential drop through the middle compartment (M) must be entirely IR drop; and if the dimensions and the current are known, it is a measure of the resistivity of the solution. But there must be also in the anode and cathode compartments respectively, as they are equal in size to the middle section, an equal IR drop, and any excess potential drop in either A or C must be due to polarization.

Hence it is necessary only to measure, during electrolysis with a given current and current density, the voltage drop in the three compartments and to subtract that in M from that in A to obtain the anode polarization and from that in C to obtain the cathode polarization, for that current density. Such measurements may be made most accurately with a potentiometer. As, however, the area of the gauzes is large, it is possible and much simpler to make the measurements directly with a sensitive voltmeter, of sufficiently high resistance that the current shunted through it has no appreciable effect upon the IR drop and causes no appreciable polarization of the electrodes.

EXPERIMENTAL WORK

In order to determine the accuracy and applicability of the apparatus and method just described, tests were made with three types of plating solution, namely, an acid copper sulfate solution, a nearly neutral nickel solution and an alkaline cyanide silver solution. In each test the polarization at both anode and cathode for several current densities was measured with (a) a calomel half-cell and potentiometer, (b) with the gauzes and a potentiometer as above described, and (c) with the gauzes and a voltmeter.

The resistivities of the solutions were also calculated from measurements made by methods (b) and (c). As a check on the apparatus, the resistivity of an exactly normal, neutral copper sulfate solution was determined in it, and was found to agree within 1 per cent with the established value for this resistivity.

CONCLUSIONS

The experiments with the normal copper sulfate solution indicate that all the results on resistivity as measured with the gauze and potentiometer are reliable to ± 1 per cent. With the voltmeter, the values obtained are never too high, and with solutions which show considerable polarization at extremely low current densities they may be as much as 5 per cent low. This degree of accuracy is, however, fully adequate for almost any needs of commercial electrodeposition.

While it is not suggested that the relatively crude apparatus with the gauze electrodes used in this study, is satisfactory for results of high precision or accuracy, it is at least possible that with suitable refinement this apparatus and principle may be used to throw light on such involved questions in polarization as transfer resistance. As opportunity offers it is hoped to extend the study to include such questions.

APPLICATIONS

The apparatus and principle described in this paper may find useful applications in pedagogy, research and industrial control.

Recent developments in electrochemistry indicate the great importance of making polarization measurements. Unfortunately, however, the term polarization is often used in such a vague way that it conveys no tangible meaning to the mind of students of physical or electrochemistry. The apparatus and diagrams shown here will probably give a new and helpful point of view on this important subject.

The numerous recent applications of polarization in studies on electrodeposition indicate the usefulness of such measurements. As formerly made, however, expensive equipment and difficult technic were required.

With this simple apparatus measurements may be quickly and conveniently made, which will at least indicate the justification for more detailed or more precise studies. Thus it is reasonable to believe that such measurements would throw light on the effects of addition agents in plating baths.

In industrial operations, such as electrolytic refining, this method furnishes a ready means for distinguishing and controlling the factors in the voltage and power consumption. Too often in such work it has been erroneously assumed that addition agents, such as glue in a copper solution, increase the solution resistivity, simply because they increase the voltage of the cell. With this method it is at once obvious that even very small amounts of glue increase the cathode polarization, which is greater with increasing content of glue, up to a certain maximum polartzation. If, as some authors have erroneously assumed, polarization is always to be avoided, the presence of the glue would be objectionable. Actually, however, it is added just to increase the polarization, which in turn governs the crystal structure of the deposit.

One obstacle to the use of addition agents, such as glue, is that it is hard to determine small concentrations of them analytically. It is shown, however, that within certain limits the polarization is determined by the glue content. Having made curves for electrolytes with specified contents of copper sulfate and acid, it is then a simple matter to measure the polarization in a solution of unknown glue content, and to compute the actual or effective content of glue. If the above assumption is correct, the important consideration is not the glue content, but the polarization, which can thus be directly measured and controlled. At the suggestion of the author this method has been used successfully for several months for controlling the composition of copper and lead refining solutions in two large plants.

For silver plating solutions, there is an apparent anomaly, for which no explanation can be offered until further research is conducted. In spite of the fact that carbon disulfide is used as a "brightener" in silver plating, it was found to decrease the cathode polarization. From data not shown it was, however, found, as is observed in practice, to increase the limiting current density, that is, the current density at which "burning" occurs. If these data are confirmed in actual silver plating, the content of carbon disulfide can probably also be determined by the polarization, even though it is less than in the pure solution.

Wrapping Paper for Silver

Q.—We wish to inquire whether you can give us some information about any special kind of paper that can be used to wrap-up silver plated containers so they will not tarnish, say for two or three months, while in stock.

A.—The only kind of paper that can be safely used to wrap silver plated containers and that will not tarnish the surface during the two or three months carried in stock, is waxed tissue. The products should then be wrapped with an outer waxed paper as the wrapper. If this method is followed there will be absolutely no danger of the products tarnishing while in stock during that period.

Silverware manufacturers have used in the past, a presumably non-tarnishing white tissue paper but they have found that the products tarnish to a greater or less extent. The waxed tissue paper solves the problem.

—C. H. Proctor.

Real and Imitation Royal Copper

Q.—There is now upon the market a method which looks to me like Royal Copper but I am not sure about this. It is a beautiful cherry color and is upon sterling silver vases and candlesticks. I would be very thankful if you could give me any information on the above.

A.—There are some very good imitations of Royal Copper finish produced by the aid of pigment or colored lacquers. Before the lacquers are applied, the surface of the metal is thinly plated with a copper deposit from a copper cyanide solution. Afterwards, it is treated with a dilute solution of polysulphide or hydrosulphuret of ammonia about 1/8 oz. to 1/4 oz. per gallon of hot water, 180 deg. F., to produce a cherry red tone upon the copper.

The genuine Royal Copper however, is produced upon either solid copper surfaces, or non-copper surfaces, heavily plated with copper from a copper sulphate solution. After the heavy copper deposit has been produced upon the metal surface to be Royal Copper finished, then such a surface should be polished to a very bright lustre; cleanse the surface carefully and it will be ready to deposit a thin coat of lead upon the copper surface. The function of the thin deposit of lead is to protect the copper surface from superficial oxidation when the articles are immersed in the molten sodium or potassium nitrate solution, that is used for the formation of the Royal copper surface. The lead solution may be prepared as follows:

Water	1 gallon
Caustic soda 73-76%	12 ozs.
Lead acetate	4 to 6 ozs.
Powdered yellow rosin	1/8 oz.

Temperature 180 to 200 deg. F. Voltage 1½ to 2½. Only a flash deposit of lead must be applied, then wash and dry the articles. In an iron kettle arranged to be heated with gas, charcoal or coke to 1000 deg. F., place sufficient sodium or potassium nitrate so that the articles may be completely covered. Immerse the articles in the molten mixture (they should be perfectly dry) until they become a low cherry red or a dark red toned gun metal blue. Remove them and allow to cool normally. Afterwards polish the surface of the articles to a lustre by the aid of soft buffs and jewelers' gold rouge powder mixed with alcohol. When a satisfactory Royal copper surface is so produced, then a color that is termed a pigeon blood red results. The color is permanent; no lacquering is required. The surface is as hard and as unchangeable as a hard vitreous enamel finish. Experiment upon small articles until you become familiar with the process before trying to produce the finish commercially.—C. H. Proctor

Soldering Fluid

Q.—We are interested to know the best relatively non-corrosive flux for use in very light brass and copper soldering; also the best neutralizing compound to use afterwards to prevent oxidation.

A.—The following mixture produces a non-corrosive soldering fluid:

Glycerine—65 parts	fluid measure
Lactic acid—49 parts	" "
Ammonia 26°—14 parts	" "

Mix thoroughly and use the same as an ordinary zinc chloride soldering flux. The best neutralizing factor for soldering fluid that remains on the soldered articles would be bicarbonate of soda solution. Add about 2 ozs. or more per gallon of hot water. Immerse the articles in the solution for a moment or two, then wash and dry out.

—C. H. Proctor.

The Bonus and the Budget

The Experience of Two Brass Plants in the Use of the Bonus to Keep Down Costs. An Abstract of a Report by the Policyholders' Service Bureau, Metropolitan Life Insurance Company

The use of the bonus principle as an extra incentive to employes, whether they be salesmen, office workrs, factory hands or other classes of employes, is now new. Properly planned and carefully administered, the bonus is one of the most encouraging stimulants which can be offered to the worker for increased production. Not only does it give the employe something to look forward to, in addition to his regular salary, but in many departments of the business its application results in an appreciable decrease in expense at a relatively small cost to the company.

A BONUS PLAN NOT ALWAYS PRACTICAL

On the other hand, a bonus plan is not always practical or desirable. With regard to the use of a bonus as a device for reducing expenses, one company says:

In the case of a large company such as ours an estimated saving in expenses usually cannot be used as a basis for paying a bonus. This is particularly true when savings in expenses for the company as a whole are used. Unusually good effort on the part of one department might be more than offset by unsatisfactory efforts and results in other departments. The first department would get no benefit from the bonus. On such a basis a bonus would work for dissatisfaction.

Moreover "savings in expenses" is not the final test by which the accomplishment of a department can be measured. Unit cost is a much more signficant index. If tonnage fluctuates considerably, unit cost usually fluctuates inversely. In so far as tonnage is not usually determined by the efforts of the individual department, a saving in unit cost is not likely to prove a satisfactory basis for paying a bonus.

If standards could be set up determining what expenses should be at various levels of tonnage, reduction of expenses below this standard might be used. But the standard is difficult to determine.

THE BONUS PLAN OF THE OHIO BRASS COMPANY

The Ohio Brass Company has had a bonus plan in effect in conjunction with its budget work for the past five years. It is described briefly by the treasurer of the company as follows:

We have had a bonus plan in effect applying to department heads and foremen as well as traveling salesmen for the past five years, which plan has worked out very satisfactorily. Due to the various divisions of our business it was necessary for us to work out a bonus plan tc fit conditions.

We have six different divisions covering different classes of material and the bonus plan is built around this fact with the idea of stimulating the business in the weaker divisions.

We set a minimum and maximum amount of business for each division, using the differences as a volume range upon which we set aside a certain per cent which is prorated at the end of the year in the form of a per cent and applied to the salaries of those participating in the bonus plan.

CLEVELAND METAL PRODUCTS COMPANY BONUS PLAN

The quotation below is taken from a letter received from Mr. Lowles, Auditor of the Cleveland Metal Products Company, and is a most specific and interesting description of the bonus plan used by this company in connection with their budget system.

In considering any plan of this kind I think it is well to eliminate at the outset, those managers or executives who are keymen and who comprise the general operating staff. These are preferably dealt with, I believe, on a profit sharing plan rather than on a limited bonus arrangement. We operate here on a budget basis which necessitates the setting of standard expense ratios for each department. In the manufacturing division we have operated for many years a bonus plan for department heads and foremen, which plan has been quite successful. This plan, however, covers far more than expense, it being our intention that the method of grading or rating these department heads should help in making them better all-round executives, rather than expense watchers exclusively.

METHOD OF GRADING AND PAYING THE BONUS

The grading is done monthly by a special committee of three men, based upon a maximum of 1,000 points which is valued at 20% of the individual's salary. That is, if a foreman's salary is $300, his maximum bonus is 20% of this or $60.

If the Committee then assign 900 points to such a foreman, his bonus earned would be $54 or 90% of the maximum.

Bonuses earned are not paid to the department head immediately, but are deposited in individual savings accounts, with a selected trust company to be withdrawn only after the end of the year. Thus the interest earned adds to the total bonus, and the presentation of the pass-book at the close of the year with a considerable sum on deposit is more effective than the payment of the individual monthly checks would be.

It would be obviously unfair to grade all foremen or department heads alike, that is with the same number of points assigned to each general subject or phase of work. Therefore a special percentage is used for each department head covering the different details of the work under his supervision, but in every case the maximum points are 1,000.

FACTORS CONSIDERED IN PAYING THE BONUS

The different headings used are:

1. Quality of production.
2. Quantity of production.
3. Cost of operation—covering not only expense of department but labor efficiency.
4. Supervision of labor turnover, lates and absentees, accidents, health and welfare.
5. Care of buildings, equipment and material.
6. General cooperation with other departments and ability to accept responsibility and accuracy of records and reports.
7. Suggestions, including the ability to inspire suggestions from employees.

Thus cost is but one item, the other being emphasized much more in some cases,—such as quality for the chief inspector, and labor turnover, etc.

Screen Wire Cloth*

Committee D-14 of the American Society for Testing Materials is carrying on an investigation into Screen Wire Cloth to determine the resistance to atmospheric corrosion of various types of non-ferrous screen cloths. In this investigation seven different compositions, namely, 90 copper, 10 zinc; 80 copper, 20 zinc; 75 copper, 20 nickel, 5 zinc; 70 nickel, 30 copper; unalloyed copper; 98 copper, 2 tin; 95 copper, 5 aluminum; were to be exposed at four locations at the Bureau of Mines at Pittsburgh, where there is a typical bad atmosphere; at the Portsmouth, Va., Lighthouse, which represents a normal seacoast atmosphere; at the Panama Canal, where the atmosphere is that of a tropical seacoast, and at the Bureau of Standards, Washington, D. C., representing a normal inland atmosphere. At a meeting of the committee it was reported that the test specimens had all been installed, laboratory tests had been made at the Bureau of Standards on the material exposed and the chemical and physical properties of the various specimens reported. The results of these tests will be given in the next annual report of the committee.

*A report to the American Society for Testing Materials, March 17-19, 1926.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER

THE ELECTRO-PLATERS' REVIEW

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Contents

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EDITORIAL

VANISHED ROLLING MILLS OF NEW YORK CITY

The news of the liquidation of the Manhattan Brass Company, noted in THE METAL INDUSTRY for last month, and on page 216 of this issue, brings to our attention vividly the fact of the disappearance of the brass rolling mill district from the metropolis. The Manhattan Brass Company, the last of its kind in Greater New York, was purchased outright by a real estate operator whose purpose it is to close out the business, liquidate assets, tear down the buildings and build apartment houses to accommodate the demands of the locality.

The history of metal rolling mills in Greater New York has been a checkered one. At one time there were a number of rolling mills and metal houses in the metropolitan district. Holmes and Griggs had a rolling mill on Second Avenue and Twenty-second Street. In Brooklyn there was the old Brooklyn Brass and Copper Company. The Manhattan Brass Company was started in 1865 with Jonathan H. Crane as the head. Outside of the city proper, but in the metropolitan district, were the Essex Brothers Silver Rolling Mills which were the first to roll nickel silver and phosphor bronze. Peter Hayden owned the plant which is now called Benson Rolling Mills, Inc., at Glen Ridge, N. J. Among the clerks for Mr. Hayden were the founders of the large silver firm, Handy and Harman. The history and development of this firm was described in the April, 1926 issue of THE METAL INDUSTRY. Most of these old firms have either changed their lines or gone completely out of the brass and copper business. Hendricks Brothers, however, are a conspicuous exception to the rule as their copper mill in Belleville, N. J., is still operating at capacity. This firm dates back to 1764 and is one of the oldest industries in the United States.

About twenty years ago the Brooklyn Brass and Copper Company found itself in the path of the Manhattan Bridge and was condemned by the city. One by one the other mills dropped out, leaving the Manhattan Brass Company as the only survivor. But the rise of land values, increased labor costs and competition of the New England and Western mills finally proved too strong. In New York City at the present time therefore, we have no more brass mills. There are, in the Metropolitan District which includes Newark, N. J., however, rolling mills in other lines. Lehmaier and Schwartz operate tin and aluminum foil mills. The Beechnut Packing Company rolls tin foil for its own purposes. The Standard Rolling Mills, Inc., roll white metals for the trade. Handy and Harman roll silver and gold, and Baker & Company roll platinum. In Perth Amboy, N. J., the Standard Underground Cable Company produces rods, bars, tubes and wire of copper and brass.

Report has it that the Holmes and Griggs mill, which later moved to Twenty-sixth street near Eleventh avenue and was called Holmes and Wessel Metal Company, was the seat of the late Theodore Roosevelt's entry into business after graduating from college. He stayed in it for a short time but his health broke down and he went West to recuperate. This company was finally taken over by the Manhattan Brass Company.

As everyone knows the brass industry began in the United States in Waterbury, Conn. For a time it was strictly local in character and spread slowly into outlying districts. New York City received its share of the new mills and seemed in a fair way to develop an industry due to the fact that it was such an important trading and selling center. But the real spread of the industry developed Westward. Since the early days, mills have been built spanning the continent and covering territories from which the Eastern mills were too far removed to exercise close control. Outside of the Naugatuck Valley in Connecticut, large mills are now located in Boston, Mass., Rome and Buffalo, N. Y.; Detroit, Mich.; Chicago, Ill.; Kenosha, Wis., and Great Falls, Mont. These comprise in a general way the northern belt. The central belt would consist of the mills in Yonkers and Hastings-on-the-Hudson, N. Y.; Perth Amboy, N. J.; Baltimore, Md.; Pittsburgh, Pa.; Lisbon, Ohio. There are also a number of small mills scattered in the smaller towns in the zone between the north and central belts.

Two sections of the country remain to be covered by local mills, namely the South and the Pacific Coast. Some day they may be filled, but at the present time there is sufficient producing capacity to take care of all sections of the country. Although Baltimore is now in a position to supply the needs of the South in sheet copper, the unusual rise of industry in that section seems to make it possible that at least another mill may some day be located in the south and the Pacific Coast may not be content to pay freight indefinitely on finished products. Perhaps if the times had been more propitious, the West Virginia Metal Products Company might have lived to supply the South with its needs in sheet brass and copper.

The rolling mill of the International Nickel Company is in West Virginia, but this is, of course, not a local mill, but a point from which nickel and Monel metal in fabricated form are shipped throughout the country.

It is noteworthy that the major part of the spread in rolling mills is taken up by large companies. The day has long passed when a few thousand dollars could help to start their owner in the wrought brass business. The small brass mills are cutting prices to an extent which makes it almost impossible for the smaller organizations to exist. It is claimed that some of the largest copper and brass organizations in the United States are among the heaviest slashers of prices in competing with each other.

While this may be somewhat exaggerated, nevertheless, it is true that the large organizations can always operate on a smaller percentage margin than the little fellows because of the volume of business which they do. Consequently, when the large mills begin to move slowly and they decide to go out and speed them up, they can if they wish, quote terms and prices utterly impossible to the small operator, who must be content to take what business he can get on a personal basis and wait for times to improve so that there will be enough left to go around. The prospect for them is not alluring.

In the meantime, it seems perfectly safe to say that the brass and copper rolling mill industry in New York City is gone, probably for good. Land values are such that only high buildings can be operated at a profit and brass rolling mills certainly cannot be operated at a profit in high buildings; they need wide, open spaces. In the big town of New York at least, real estate is certainly a more profitable business than rolling brass.

PLATERS' CONVENTION IN NEWARK

The coming convention of the American Electro-Platers' Society in Newark, advance reports of which will be found on page 207 of this issue, will be followed with more than ordinary interest by electro-platers and manufacturers interested in electro-plating. We, ourselves, confess to a great deal of curiosity as to what the Newark Branch will do with its convention. This Branch is known for its activity and the excellence of its meetings. It is made up of "live wires" who have always done well what they set out to do and they rank as one of the most progressive branches in the Society.

The American Electro-Platers' Society has before it several problems which confront it in the near future. The Research Fund is probably the most important and every effort should be made, and is being made, to bring this project to a successful conclusion. THE METAL INDUSTRY has repeatedly urged manufacturers to contribute the small sum asked. We stand ready also to aid the platers by publishing freely news of their activities and occasionally papers from the Monthly Review. We can say without hesitation that the publication of such papers is fully as much to the interests of the Society as of ourselves. It would increase, by several thousand, the circulation of the Society's papers. We must repeat therefore, the opinions which we have stated in the past, that it would be to the interest of the Society to permit the publication of papers read at these conventions immediately after they have been read.

Other problems are before the Society, but we have no doubt that it will overcome them as it has overcome difficulties in the past. The American Electro-Platers' Society is unique in its character, probably the only technical society in existence made up of non-technical men, and bids fair to become one of the outstanding societies of the United States.

A number of progressive manufacturers are paying for the time and expenses of their foremen platers in attending the convention. This is a practice that might well be followed by many more.

THE BUSINESS SITUATION

It is well known that the metal trades are secondary in character; that is they do not go as such directly to the consuming public, but depend upon other trades for their rate of consumption.

Among the most important of trades is the building trade and for that reason the building situation will interest most metal manufacturers. The Copper and Brass Research Association has published a very interesting forecast of building for the coming year, showing that the building shortage has not yet been overcome and that, together with normal growth, another big year should ensue.

In 1923, almost $6,000,000,000 was spent for building; in 1924, $5,340,000,000; 1925, $5,800,000,000. Average, normal, yearly building, it is stated, amounts to about $4,400,000,000 and it is predicted that almost another billion dollars will be spent to make up the shortage which still exists.

This is interesting and re-assuring as the building industry is one of the large consumers of metals and metal products. As regards other industries such as electrical industries, automobiles and railroads, no definite figures are obtainable as yet. It is safe to say that the electrical industries will continue to grow steadily. Power developments promise to be of the most extraordinary character, as hundreds of millions of dollars have been definitely set aside for expansion in this field. Railroads bought comparatively little in 1925, but their profits were on the whole very good. It is expected therefore, that their purchase in 1926 will be large. The automobile trade is unpredictable but it is obvious both from general signs and from the action of the New York stock market that a falling off is expected.

Several points are being watched with particular interest as indicators of this year's business, one of which is the retail trade. So far the retail trade has been fair, with some bad spots, although it is claimed, held up to a fair extent by the installment method of buying, which is decidedly unsafe if carried too far.

Evidence of the stability of business is the fact that the American Brass Company during the first three months of 1926 shipped 12½ per cent more material to consumers than it did in 1925. Moreover, orders and contracts at the close of the first quarter of 1926 were 13 per cent greater than at the same time of last year. Insiders will, of course, ask for more information than this; they will want to know the profits earned during this period and during the year 1925, as a check on whether the vast amount of business was done at good prices or at cut rates. Nevertheless, it is always cheering to know that the wheels are turning and even if prices are not what they should be, if the consuming power is there, better times will follow.

The General Electric Company showed an increase of 3 per cent during the first three months of 1926 over the same period of 1925. Published opinions of such industrial leaders as Charles M. Schwab, Secretary Mellon, and Secretary Hoover, seem to indicate that 1926 will be steady.

Foreign trade has fallen off but not abnormally for this time of the year, and no real alarm is felt. Conservative observers feel that 1926 should be a good year, but not a record-breaker. It may fall a little below 1925 but should show no such wild fluctuations, as might be feared from the action of that nervous and over-delicate barometer, the stock market.

GOVERNMENT PUBLICATIONS

Magnesium and Its Compounds in 1924. By J. M. Hill and G. F. Loughlin. Department of Commerce, Bureau of Mines, Washington, D. C.

Sand and Gravel in 1924. By Estelle R. Phillips. Department of Commerce, Bureau of Mines, Washington, D. C.

Fuel Briquets in 1924. By W. F. McKenney. Department of Commerce, Bureau of Mines, Washington, D. C.

Gypsum in 1924. By K. W. Cottrell. Department of Commerce, Bureau of Mines, Washington, D. C.

Abrasive Materials in 1924. By Frank J. Katz. Department of Commerce, Bureau of Mines, Washington, D. C.

Production of Bauxite in United States in 1925. Department of Commerce, Washington, D. C.

Production of Slab Zinc and Rolled Zinc in 1925. Department of Commerce, Washington, D. C.

Production of Aluminum Salts in 1925. Department of Commerce, Washington, D. C.

Preliminary Report on Quicksilver Situation in 1925. Department of Commerce, Washington, D. C.

Zinc in 1924. By Siebenthal and Stoll. Bureau of Mines, Washington, D. C.

Refined Platinum and Allied Metals in 1925. Department of Commerce, Washington, D. C.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. PETTIS, Rolling Mill; W. J. REARDON, Foundry; W. L. ABATE, Brass Finishing; CHARLES H. PROCTOR, Plating Chemical; P. W. BLAIR, Mechanical

BRIGHT BURNISHING

Q.—We do job plating mechanically, but, we are unable to produce for our customers, the high finish they demand—by burnishing. Stampings, steel and brass, screws, bolts, nuts, etc. Recently one of our lost customers showed me some of the work he is getting now. It is like a hand job. Can you help?

Our barrels are hexagonal, lined with hard wood; 60 revolutions per min. Burnishing powder is used (we tried soap chips but had trouble cleaning for plating). Does size of steel balls make any difference on different kinds of stampings?

A.—Do not use soap chips for ball burnishing steel parts before plating. The soap becomes hard and difficult to remove. When it is removed by final cleansing, the bright finish is all gone. Use the following solution with plenty of steel balls.

Water—1 gallon
Soda ash 58%—3 ozs.
Sodium cyanide 96-98%—½ oz.

After the steel has been tumbled by the aid of this burnishing solution, you can wash the product in cold water thoroughly and plate direct. After the product is plated with nickel, copper or brass, use soap bark as the burnishing factor. Water, 1 gallon; soap bark, ¾ ozs. Steel balls should not exceed ⅛ inch in diameter for best results.—C. H. P. Problem 3,518.

BRIGHT NICKEL

Q.—Could you send me a formula for a bright nickel silver solution, for plating metal, such as lead and pewter?

A.—You mention nickel silver. This is the old term for a nickel plated deposit so we are answering you accordingly. Formula for Bright Nickel solution:

Water	1 gal.
Single nickel salts	12 ozs.
Nickel chloride	1 oz.
Boracic acid	2 ozs.
Sal-ammoniac	2 ozs.
Cadmium chloride	5 grains

which may be increased up to 10 grains per gallon, but not exceeded.

A little free muriatic acid should be added occasionally to all bright nickel solutions. When cadmium is used as a brightening agent, 1/16 to ⅛ oz. per gallon of solution will be ample at one time. When the nickel deposit becomes dull again, a little more cadmium chloride should be added. When bright nickel solutions are operated in mechanical barrels, or conveyor type of solutions, then two or three cadmium metal sticks may be used as anodes with the nickel anodes. The cadmium metal sticks are 9 inches long by ⅜ to ½ inch in diameter.—C. H. P. Problem 3,519.

BRIGHT YELLOW BRASS DEPOSIT

Q.—What is a good formula for a bright yellow brass deposit?

A.—The most universally used brightener for brass plating solutions is powdered white arsenic, dissolved in a strong solution of caustic soda. Not more than 1 grain of arsenic should be added to the solution per gallon at one time. The proportion may be increased as found desirable, but care must be taken to avoid an excess which results in brass deposits of a gray tone. Preparation of arsenic solution:

Water (cold)	16 ozs.
Caustic soda 73-76%	4 ozs.
Powdered white arsenic	1 oz.

After adding the caustic soda to the cold water, heat to 180° F. and then add the arsenic with stirring until dissolved. There are 438 grains in an avoirdupois ounce, so the amount of arsenic solution prepared as given will be ample for the same number of gallons of solution, minimum. Other brightening factors are nickel cyanide, bisulphide of carbon and Cresilic acid (which is the basis of carbolic acid). All these factors which are collodial in their action on the brass deposit should be added in relatively small proportions, never exceeding at any one time, additions more than 1 grain per gallon of solution, which may be repeated as may be desired.—C. H. P. Problem 3,520.

ELECTRO-TINNING CANS

Q.—Kindly give me a formula for tinning ice cream cans by electro-plating.

A.—In re-tinning ice cream cans with an electro deposit of tin, the cans must be clean and free from rust and old tin. The following solution will plate tin very rapidly, and after the cans have been tin-plated and thoroughly washed, and dried, they can be scratch brushed to a lustre with either steel or brass wire scratchbrushes.

Tin solution:

Water	1 gal.
Sodium stannate	28 ozs.
Tin crystals	2 ozs.
Powdered starch	¼ oz.

Temperature of solution, 160° to 180° F. Voltage 4 to 5. For plating the inside of the cans, place the tin solution in the can and use a steel anode, made circular, like a tube, about 3 to 4 inches in diameter. Anodes of tin and sheet steel should be used in a regular solution. Sodium stannate and tin crystals can be purchased from any good chemical company advertising in METAL INDUSTRY.—C. H. P. Problem 3,521.

GALVANIZING (ZINCING) PICKLE

Q.—I am writing you concerning a sheet iron pickle for galvanizing. Can you furnish me with the amount of water and the amount of sulphuric acid to make up a tank, 10 ft. long, 8 ft. deep, 2 ft. wide? I have always used muriatic acid.

A.—A pickling solution for your purpose should consist of

Water	1 gal.
Sulphuric acid 60° or 66°	12 ozs.
Common salt	2 ozs.

Temperature of solution 120° to 180° F., the sulphuric acid acting upon the common salt forms some muriatic acid in the pickle. The tank will hold 1200 gallons of solution. This will reach up to within 4 or 5 inches of the top of the tank which should be ample. The product to be pickled will increase the bulk of the solution, so it would not be safe to fill the tank. It will require 112 gallons of sulphuric acid by measure, and 150 pounds common salt and 1078 gallons of water.

The use of powdered lignine that forms a blanket on top of the pickle is advisable because it keeps the pickle from evaporating to a great extent. It also confines the hydrogen in the pickle. The results are that more work is done for the amount of acid consumed. This material is sold under several trade names. It is a sulphite by-product that accumulates in the paper industry.—C. H. P. Problem 3,522.

MOLDING FLASKS

Q.—On our molding machine we are using iron bands, one for cope and one for drag, which are placed in the snap flash before the sand. We think that these iron bands are superfluous and that they can be dispensed with by using a tapered flask. After being placed upon the floor a tapered steel jacket is slipped over the mold.

A.—On brass molding wherever you have any kind of heavy work we always favor the solid iron flask. For light brass work or aluminum we favor the tapered flask, over the bands. However, they both have their advantages and disadvantages. If the steel jacket is made so that it will not warp with the heat, it will give very good results. If not a lot of trouble is experienced; the

same with the iron band. If used with care and the work is not heavy and the bands do not warp or bend, they are quite satisfactory. It is all a matter of choice. Some foundries will not use bands and others will not use the slip-overs.

The best method is to use the one that is most suitable to your foundrymen. If you have one to one-and-a-half inches of sand between the casting and the edge of the flask, we are of the opinion that the tapered flask would be the fastest method and give as good results. But for brass work you will find the steel solid flask the most satisfactory, as less metal is lost by spilling on the floor and the castings can be poured with more pressure and insure better work.—W. J. R. Problem 3,523.

NICKEL ON ZINC

Q.—I have just taken charge of a plating room, making hub caps for automobiles. These hub caps are made of zinc sheet and have to be nickel plated. Now this man is running a nickel solution strongly acid with small anode surface. The solution is: double nickel salts, 4 ozs.; single salts, 8 ozs.; sulphuric acid, 3 ozs.; sal-ammoniac, 2 ozs.; water, 1 gallon, and has only 16 small anodes in a tank, 8 ft. long, 2½ ft. wide; 1 cathode rod; plates at 3 volts, 100 amps., and plates work about 5 minutes. The solutions will last only about half a day, and then they run about half of it into the sewer. Then they start to build up a solution. They have tried solutions for die castings, but will not work. What I want to get is a formula of a solution that will stand up and one that we can put on a larger plate. I advised this man to give his work a dip in a sodium sulphate solution, then right into the tank. What do you think of that?

A.—We do not see how it is possible to obtain a nickel deposit upon auto hub caps made of sheet zinc with such a nickel solution as you describe. No wonder the solution can only be used for a short time and then goes down the sewer. We suggest the following formula:

Water	1 gal.
Single nickel salts	10 ozs.
Sal-ammoniac	3 ozs.
Boric acid	2 ozs.

When the solution has been made up, then add 12 ozs. crystallized sodium sulphate per gallon of solution. Voltage at least 5; amperes maximum on tank load without burning. If the caps were given a flash deposit in a warm copper cyanide solution, the results would be more satisfactory.—C. H. P. Problem 3,524.

OXIDIZING BRONZE TABLETS

Q.—Kindly give us a formula for the best solution for oxidizing bronze tablets. We have experienced some difficulty in getting the color uniform. We want a dark bronze finish as a background for name-plates, etc.

A.—The following methods should give you a satisfactory dark bronze finish upon bronze metal tablets:

1. The necessary polishing should be applied to the tablets on the high lights. The background should be clean and free from sand and oxide.

2. Scour the tablet with powdered pumice stone mixed to a paste with water; add 2 ozs. sodium cyanide to each gallon of water used. Scour with a hand bristle or Tampico brush; afterwards wash thoroughly with cold water.

3. Heat the tablet by immersing in boiling water or upon a steam table; drain quickly if water is used.

4. Apply with a sponge or soft brush a hot oxidizing solution, 180° F. or less, composed of: water, 1 gal.; polysulphide or liver of sulphur, 4 ozs.; aqua ammonia, 2 ozs. Apply rapidly until the dark bronze tone results, then wash quickly in cold water or by the aid of a hose; wash in boiling water and dry out in maplewood sawdust.

Afterwards remove the dark bronze finish from the high-lights with emery cloth or by polishing with emery wheel, 160 emery. Dust off and either lacquer with a brush or spray, or wax with a good floor wax paste; remove the excess with soft cloths and rub down to a semi-lustre.—C. H. P. Problem 3,525.

REMOVING ENAMEL FROM ALUMINUM

Q.—I am in charge of the enameling department for a local concern. We are having considerable trouble in removing black enamel from rejected aluminum stampings which we can use by painting again after we get them clean. What kind of a cleaner would you suggest that would take off this automobile enamel which is baked on hard? The metal is not heavy enough to stand much tumbling. Caustic solutions, of course, eat the metal and are not satisfactory.

A.—The removal of baked enamel from aluminum articles is somewhat of a difficult problem, if tht articles are to be re-enameled.

Strong and hot caustic soda and soda ash combinations are used for the removal of baked enamels from steel, but for aluminum such radical alkalies are out of the question. If you can tumble the articles a little, then a cold solution of tri-sodium phosphate and an abrasive, such as sea sand, might be tried out. The tumbling solution might consist of water, 1 gallon; tri-sodium phosphate, 4 to 8 ozs. The sand would assist in the removal of the enamel by the friction of tumbling. If this method does not prove successful, then you might try carbon tetrachloride or trichlorethylene; the latter material should dissolve the enamel in a short time. —C. H. P. Problem 3,526.

SATIN FINISH ON ALUMINUM

Q.—Please send us a formula for an acid solution for obtaining a matt-satin finish on sheet aluminum. We have some aluminum reflectors which require a matt-satin finish and we have been unable to get the proper results with our acid mixtures.

A.—If you desire to produce a distinct matt or satin finish upon aluminum, it will be necessary to resort to a steel wire satin-finishing scratch brush. Afterwards the aluminum articles should be immersed in a hot alkali cleaner for a moment or two until the surface becomes dark. Then wash in clean cold water, drain thoroughly and immerse in an acid dip prepared as follows: nitric acid 38°, 2 gallons; sulphuric acid 66°, 1 gallon. Do not add any water, and be careful that none gets in from the aluminum articles.

It is necessary to immerse the articles in the dip only for a moment or two, then wash the articles thoroughly in cold and boiling waters; dry out in maplewood or similar hard wood sawdust. You can try out the alkaline cleansing and acid dipping first, and note results. If satisfactory, you can omit the scratch brushing. This can best be decided by test.—C. H. P. Problem 3,527.

SILVER SOLUTION

Q.—Would you please tell me about what a 70-gallon silver solution would cost to make? What chemicals would be required? Also give me formula for solution.

A.—The following formula can be used with excellent results: The metal content is about the minimum that can be used to obtain fairly heavy deposits. For light silver plating, the solution can be made up one-half the strength and still give good results.

Water	1 gal.
Sodium cyanide, 96-98%	3 ozs.
Silver cyanide, 80½%	2 ozs.
Carbonate of potash	½ oz.
Ammonium chloride	¼ oz.

Temperature of solution, 80° F. Voltage, ½ to 1. Anodes, fine sheet silver. The silver content of the solution will equal 1.60 ozs. per gallon. If necessary increase the cyanide content if the anodes do not remain clean. Do not add more than ¼ oz. per gallon at any one time. To prepare the solution, place ¾ of the total amount of cold water in the tank or receptacle first, then dissolve the carbonate of potash and ammonium chloride. The balance of the ¼ water should be seated to 140° F. and placed in a separate receptacle. Add the cyanide and stir into the water, then add the silver cyanide. When dissolved, add the solution so prepared to the water in the tank; stir thoroughly and the solution will be ready for use. The cost of the solution will approximate about $1.46 per gallon. The dilute solution will be ½ this amount.—C. H. P. Problem 3,528.

STREAKING COPPER PLATE

Q.—I am having a little trouble with my hot copper solution. It seems to plate streaky. I am sending under separate cover a sample of the work we are having trouble with. Perhaps you could advise us what to use to overcome our difficulty.

A.—You did not give us the composition of your copper solution. Usually streaks in the copper deposit result from a low, free, cyanide content. Increase the free cyanide from 1 to 2 ozs. per gallon of solution. If the streaks still show up in the copper deposit, then add 2 ozs. sodium hyposulphite to each 100 gallons of solution. We believe these additions will eliminate the streaks in the deposit.—C. H. P. Problem 3,529.

PATENTS

• A REVIEW OF CURRENT PATENTS OF INTEREST

1,574,055. February 23, 1926. **Fabrication of Metal Sheets by Electrodeposition.** Arthur Z. Pedersen, West Orange, N. J., assignor to Madsenell Corporation, New York, N. Y.

The method of making a plurality of separable sheets of an anodically corrosive metal by electrodeposition which comprises reversing the direction of the flow of current between successive depositions.

1,574,544. February 23, 1926. **Method of Depositing Silver.** Blasius Bart, East Orange, N. J.

In the art of coating objects with silver, the process which consists in mixing a solution of a silver salt with a reducing agent therefor, maintaining the association in the absence of air and for a period of time less than the period necessary to permit a complete reduction of the silver salt present and spraying the resulting partially reduced substance in the form of a mist and in the presence of air onto the surface of the object to be coated.

1,574,714. February 23, 1926. **Dental Alloy and Process of Making the Same.** Clarence C. Vogt, Pittsburgh, Pa., assignor to Lee S. Smith & Son Manufacturing Company, Pittsburgh, Pa.

A dental alloy containing silver and tin in amounts which will readily amalgamate with mercury to form a suitable hardening dental amalgam, together with a minor proportion of tungsten, substantially as described.

1,575,768. March 9, 1926. **Lead Covering of Electric Cables and the Like by Extrusion.** Ernest Edward Judge, Gravesend, England, assignor to W. T. Henley's Telegraph Works Company, Limited, London, England.

A press for the continuous extrusion of lead sheathing on electric cables and the like comprising a cylinder adapted to be charged with molten lead, a supporting ring at the rear end of said cylinder, a tubular point holder supported so as to form an annular space within said cylinder by having its rear end mounted on said supporting ring, a plunger adapted to be reciprocated in said cylinder, said plunger having sector-like guide members adapted to slide through corresponding apertures in said supporting ring and an annular front end filling the annular space between said cylinder and said tubular point holder.

1,575,926. March 9, 1926. **Plating Device.** Nikolaus Meurer, Berlin-Tempelhof, Germany, assignor to Metallogen Gesellschaft mit beschränkter Haftung, Berlin-Neukolln.

A device for producing metallic coatings comprising a chamber with a plating compartment and a preheating compartment above the plating compartment, two perforated hinged plates between the said compartments, means for tilting the said plates down from a horizontal position in which they form a support for the objects to be plated into oblique positions, and a rotable drum arranged in the plating compartment and adapted to receive the said objects.

1,576,725. March 16, 1926. **Apparatus for Applying Coating.** Herbert W. Day, Wollaston, Mass., assignor to Painting & Finishing Equipment Sales Company.

A tool for applying coating comprising a body having passages for coating material and for a motive agent under pressure there being in said body a plurality of pairs of spaced, supplemental, motive passage leading from said motive agent passage and distributed in a circular series thereabout and a member supported upon said body and having a pair of opposed supplemented motive agent discharge passages, said member having turning movement, without necessary substantial longitudinal movement, upon said body into and out of communication with selected supplemental motive passages.

1,577,124. March 16, 1926. **Refractory Article and Process of Making the Same.** Arthur J. Jackson, Forest Hills Borough, Pa., assignor to Vesuvius Crucible Company, Swissvale, Pa.

As a new article of manufacture, a refractory article consisting principally of graphite and a vitrifiable ceramic bond, and burned prior to use to a temperature above the vitrification point of the bonding material.

1,576,080. March 9, 1926. **Method of Recovering Light Metals from Scrap and the Like.** Adolf Beck, Griesheim-on-the-Main, Germany, assignor to the firm, Chemische Fabrik Griesheim-Elektron, Griesheim-on-the-Main, Germany.

The process for recovering light metals, such as magnesium and aluminum or their alloys from scrap and other impure metallic mixtures, which comprises melting the metal to be treated, adding magnesium chloride and a substance adapted to act as a thickening medium on magnesium chloride, stirring the mixture and separating the molten metal from the foreign substances.

1,577,357. March 16, 1926. **Method of Plating Composition Bodies.** Felix Peano, Inglewood, Calif.

The method set forth of producing a metal deposit on a composition body consisting of first mixing a setting material to form a plastic mass, then mixing metal wool with such mass, then modeling the mixture into a body of the desired form, then allowing the body to set, then treating surfaces of the body to expose portions of the metal wool, and then treating the body to build up a metal deposit thereon.

1,577,995. March 16, 1926. **White-Gold Alloy.** Edmund Merriman Wise, Dayton, Ky., assignor to the Wadsworth Watch Case Company, Dayton, Ky.

A gold alloy containing from 30 per cent to 80 per cent gold and containing nickel, copper and zinc in the relative proportions of 33.0 to 53.1 parts nickel, 26.4 to 46.5 parts copper and 10.6 to 30.7 parts zinc.

1,578,044. March 23, 1926. **Method of Purifying Molten Metals.** Howard G. Lapsley, Plainfield, N. J., assignor to Metals Refining Corporation.

The method of treating molten metal which comprises adding thereto a chemical compound of aluminum and boron.

1,578,254. March 23, 1926. **Protection of Metals Against Corrosion.** Irving T. Bennett, Brooklyn, N. Y., assignor to Thomas E. Murray, Brooklyn, N. Y.

The method of protecting the surface of ferrous metal, which consists in applying chromium thereto and applying a protective layer of nickel over the chromium.

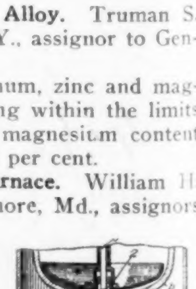
1,578,464. March 30, 1926. **Enamel Finish.** George J. Nikolas, Chicago, Ill.

A solid body having its face coated with a smooth and hard multiple layer coating of uniform finely speckled appearance, including a colored lacquer-like coat having lustrous particles of solid pigment set in its face, a medial layer of transparent lacquer-like material blended integrally therewith and containing similar particles, and a protective outermost coat of transparent material.

1,578,979. March 30, 1926. **Aluminum Alloy.** Truman S. Fuller and David Basch, Schenectady, N. Y., assignor to General Electric Company.

An alloy consisting essentially of aluminum, zinc and magnesium, the zinc content of said alloy being within the limits of about three to eight per cent and the magnesium content being within the limits of about 0.25 to 1.5 per cent.

1,579,077. March 30, 1926. **Melting Furnace.** William H. Chenowith and George C. Schimpf, Baltimore, Md., assignors to Harry D. Harvey, Baltimore, Md.



A melting furnace comprising a vertically extending casing having a cylindrical wall and having a horizontal slot in said wall, a melting pot in said casing, said pot having an outlet, and a spout swiveled to the pot at the outlet and extending through said slot.

1,579,435. April 6, 1926. **Metal Cleaner and Polisher,** Brice L. Clutier, Chicago, Ill., assignor to Lightning Products Corporation.

A metal cleaning and polishing compound consisting of the following ingredients in approximately the following proportions by weight twenty-five parts of hard silica, thirty parts of petroleum and fifteen parts of stearic acid.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

ACID RESISTING ALLOY

The Alcumite Corporation, Dayton, Ohio, a division of the Duriron Company, Inc., has placed on the market a new alloy, called Alcumite. Alcumite is a copper base alloy with aluminum, iron, nickel and manganese. It was developed primarily to produce a machinable, strong metal for sulphuric acid service.

With its tensile strength and non-rusting properties are said to be combined a resistance to shock and fatigue, even at elevated temperatures, that makes practicable many machines or processes previously considered impossible or uneconomical. Even the high coefficient of expansion of Alcumite may be advantageously utilized for many types of machine and engine construction. It can be cast, forged, rolled, drawn and machined with the same tools and equipment used for steel, and it may be substituted in almost any apparatus without change of design.

It is claimed that castings free from porosity are readily produced, and from properly designed patterns, valve bodies, cylinders and other castings have been made which withstand hydrostatic pressure up to 1,000 pounds per square inch. It is only necessary to design castings with a uniform wall thickness, and to avoid as far as possible changes in metal section, such as bosses, heavy ribs and flanges.

Alcumite is machined similarly to medium carbon steel. Tools should be sharp and have plenty of clearance. A cutting speed of about eighty feet per minute is the most satisfactory.

CHARACTERISTICS OF ALCUMITE AT ELEVATED TEMPERATURES

	Room Tem.	500° F.	750° F.	900° F.
Tensile Strength	73,165	58,740	36,525	23,560
Yield Point	22,440	26,520	23,460	17,340
Elongation	38.5	18.5	6.4	7.5
Reduction of Area	35.0	30.0	13.0	10.5

PHYSICAL PROPERTIES OF ALCUMITE

Specific Gravity	8.3
Weight per cubic inch, cast	.29 lb.
Metal point	1,900° Fahr.
Coefficient of expansion, per degree Fahr	.00000935
Thermal Conductivity: B. T. U. per sq. ft. per hr. per deg. Fahr. difference in temperature, per one foot thickness	60
Electrical Resistivity, microhms per cubic centimeter (or 112 ohms per circ. mill foot)	18.6
Electrical Conductivity	9% of Copper
Casting Shrinkage, inches per foot	3/16

FORM	Tensile Strength Lbs. per Sq. In.	Brinell Hardness†	Yield Point Lbs. per Sq. In.	Per Cent Elongation in 2 In.	Reduction of Area
Green sand castings	75,000*	116	25,000	30%	35%
Hot rolled rods and sheets, annealed	90,000	132	47,000	25%	38%
Hot rolled rods and sheets, not annealed	100,000	187	52,000	10%	18%
Wire, .032" diam.	142,000	...	.....	....	....

† Brinell hardness determined with 3,000 kilogram load and a definite time interval of 30 seconds.

ELECTRIC MELTING POTS

Harold E. Trent, 259 N. Lawrence Street, Philadelphia, Pa., is manufacturing electric melting pots for babbitt, type metal, solder, lead, tin, and other alloys melting at temperatures up to 1,000° F.

Trent electric melting pots are made in 4 standard sizes, the largest having a capacity of 1,500 pounds, the smallest having a capacity of 10 pounds. These are electrically heated and controlled by hand or by thermostat.

Special attention has been given to the speed of melting and to the means taken for automatically maintaining the working temperature for various soft metals and alloys.

The crucibles are constructed of high grade cast iron to resist the action of antimony at high temperature.

Because of the characteristics of heating and control, it is claimed that substantial economies may be realized in the manufacture of babbitt bearings. Portability is assured as connections can be made to locate the pot at any convenient position.

High temperature insulation assures the greatest economy of heat and satisfactory working conditions for operators.

FIG. 1. TRENT ELECTRIC MELTING POT.

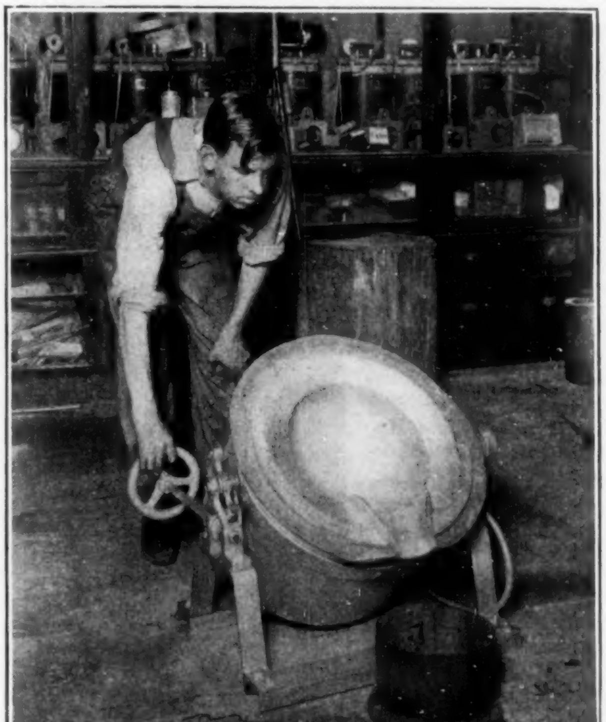
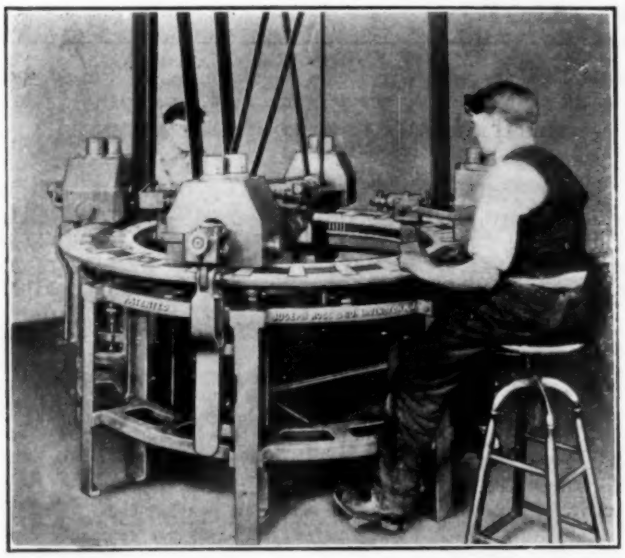


FIG. 2. TILTING ELECTRIC MELTING POT.

ROTARY FLAT SURFACE GRINDING AND POLISHING MACHINE

The illustration below shows a new type of polishing and grinding machine for flat surfaces, which Joseph Ross & Company of Irvington, N. J., are placing on the market as their Model A Continuous Rotary Dial Feed machine. It consists of a frame, substantially built and a solid cast iron rotary table with adjustable bearings for polishing or grinding wheels. The rotary table or grinding bed runs on adjustable rollers and has a worm drive. The polishing heads can be raised or lowered by means of one screw to suit the thickness of the article desired to be worked and are further made adjustable by compensating springs.



ROTARY DIAL FEED GRINDING MACHINE.

The wheels are mounted on heavy spindles and easily changed. An oscillating attachment to the spindles produces results surpassing, it is claimed, those accomplished by hand work. Coarse abrasives can be followed by finer ones without interrupting operations.

The Model A machine weighs 2,500 pounds, the table is 12 inches wide, 75 inches in diameter, can be built with 4 or 6 spindles and requires a floor space of 8 feet square. Larger sizes can be constructed if required.

The operation consists simply of taking off a finished article and putting an unfinished one in its place, which does not require any skilled labor. The production is continuous. Tallow can be used as a lubricant or an automatic oil lubricating attachment can also be supplied. For dry polishing, suitable provision is made for blower pipes. Any style or combination of wheels can be used, such as leather, canvas, felt or buffs.

It is stated that push plates have been polished at the rate of 1,200 per hour and smaller articles, by the use of double fixtures, at a rate much greater.

NEW SCHOOP SPRAY GUN

The Schoop process of spraying metals, now used extensively in many industries for a wide variety of purposes, is used to produce coatings of metal on whatever object is to be sprayed, regardless of shape, material or size, the most important application probably being the rustproofing of iron and steel.

It has been found that certain metal coats obtained in this manner do not always show the normal physical and chemical characteristics of the original metal, this being especially noticeable when spraying baser metals such as lead. The layer of metal has a tendency to be harder and more brittle, which is apparently due to the fact that the metal spray represents a very large raction-zone, where the particles of metal react with the oxygen of the air of the products of combustion, and perhaps even with the oil and moisture usually entrained in the compressed air. The loss in ductility has also been noticed in the precious metals, for instance gold and platinum, but in less pronounced degree.

This increase in brittleness, while in most cases not objectionable, is sometimes undesirable and due to the efforts to find a way to eliminate this feature, a new principle of metal-spraying has been discovered and embodied in the latest Schoop spray gun developed by Werner Schoop, 1020-A Commodore Drive, St. Louis, Mo., which is said to do away with the above mentioned defects and therefore represents an important development in the art of metal-spraying.

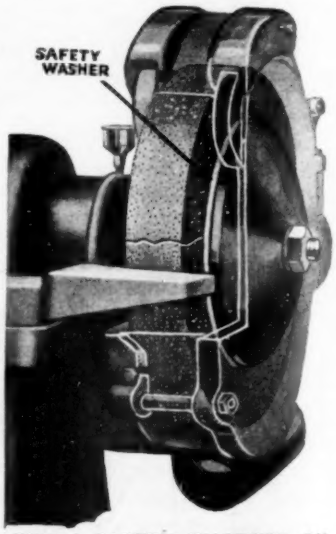
NEW SCHOOP SPRAY

In the spray apparatus used heretofore, the metal was introduced in wire shape and fed at a certain rate of speed through a nozzle where it was melted by an oxy-acetylene flame, the molten metal being atomized and sprayed on the object to be coated by a jet of compressed air. The new pistol uses a device which melts the wire before it leaves the nozzle, with the result that the metal does not come in contact with any flame either during or after the melting process. It has also been found that the use of preheated air, instead of the cold air used previously, for the spraying of the molten metal gives decidedly better results; the metal particles are not cooled as suddenly and the oil and moisture contained in the air are evaporated.

It is now possible to produce coatings of tin and lead which are in no way difficult from other, normal tin and lead coatings.

SAFETY WASHERS FOR GRINDING WHEELS

The Perks Safety Washers, made by the George W. Perks Company, Akron, Ohio, consist of metal disks to each of which has been vulcanized a sheet of high grade specially prepared rubber, and after removing the paper, one of these washers is applied to each side of a grinding wheel with the rubber adjacent to the grinding wheel. Thus, when the pressure of the outside recessed steel flanges is applied the rubber is forced into the porous surface of the wheel, thus securing it in place.



PERKS SAFETY WASHERS ON GRINDING WHEEL.

In this manner the stress in the wheel, due to the centrifugal force, is transferred, through the medium of the rubber, to the metal back of the safety washer which in turn with the shaft carries the load.

An important feature of these safety washers is that they serve as lock washers in a most effective manner as well as supplying the necessary cushion.

The danger of cracking wheels from too much clamping strain is said to be eliminated; also danger from wheels injured in transit, storage or otherwise.

It is advised that the safety washers and flanges be approximately 60 per cent of the diameter of the wheel.

In all cases the recessed flanges should be used in connection with the safety washers as, in addition to the ordinary advantages of recessed flanges, concentrated pressure is thus afforded

NEW SPRINGLESS VIBRATOR

The Malleable Iron Fittings Company, Branford, Ohio, has placed on the market a new springless vibrator for use in the foundry.

Based on the reports from seventy-five foundries scattered over the United States extending over a trial period of three months prior to January 1, 1926, the following advantages and performances are claimed:

1. No spring is required, due to oblique position on plate, and new arrangement of air ports.

2. The vibration is imparted to plate or to a pattern in a semi-horizontal and vertical direction, producing minimum distortion of form produced by pattern in the mould—and the resulting castings are closer to pattern and consequently nearer to weight desired.

3. Study of weights on a job requiring 100,000 castings disclosed that 12,500 more pieces were produced by Branford Springless Vibrators than on the old style horizontal vibrator due to closeness of moulding. This amount was gained from the same amount of metal poured, as the saving was one ounce per casting.

4. The Branford Springless Vibrator can be used in one or two sizes smaller than the horizontal type—making the vibrator cost less.

5. The Branford Springless Vibrator is a detector of patterns with insufficient draft, or under or reverse draft found on cast plates due to shrinkage at junction of pattern to plate. The old way was to put on larger sizes of vibrators until mould was enlarged enough to draw the pattern. When the Branford Springless Vibrator will not free the pattern, **Check Up the Draft on Pattern.**

NEW SPRINGLESS VIBRATOR

AUTOMATIC FLAT SURFACE POLISHING MACHINE

A new automatic machine for polishing flat stock and flat surfaces is announced by Divine Brothers Company of Utica, N. Y. This is the first machine on the market designed to do this class of work automatically, and practically every industry in which polishing of flat pieces enters will be interested.

The classes of work to which this machine is adapted are legion. Flat bars and strip steel, or similar forms of other metals; flat surfaces such as require polishing on calculating machine and cash register parts, typewriter parts, builders' hardware, cabinet hardware—the list could be almost indefinitely extended—have hitherto been polished by hand by skilled, highly-paid workmen, which will be unnecessary with the introduction of this new automatic machine. The material to be polished is placed on a feed belt which carried the work under a series of polishing wheels, where the entire process is completed mechanically.

Anything from a thin sheet to a piece of metal several inches in thickness may be polished on this machine, which is also built with various widths of feed to take any width of pieces of stock from the narrowest up to 20 inches or more. Contact between the work and the polishing wheels is maintained by a micrometer adjustment. The polishing wheels are both weight and spring balanced, thus providing mechanically just the right delicacy or "touch" or "feel" required for polishing.

Each polishing wheel is driven by an independent direct drive motor. The machine is built in units, each unit carrying an independently operated polishing wheel. Any number of units may be used in one battery to suit any required polishing process or any production output. Moreover, more units may be conveniently grouped or added to equipment already on hand to take care of increased production. The machine is equipped with a variable speed transmission which gives a selection of feed belt speeds from 5 to 25 feet per minute.

DIVINE FLAT SURFACE POLISHING MACHINE.

TEST ON METAL CLEANER

The A. C. Nielsen Company of Chicago, Ill., an engineering organization, ran a test recently on cleaning materials for metals at the plant of the Detroit Lubricator Company, Detroit, Mich. The problem consisted of the cleaning of valves, valve parts, carburetor parts, screws, etc., of a white deposit of chloride of lime, preparatory to plating. It is stated in the report of this test by C. H. Hodges, Jr., factory manager of the Detroit Lubricator Company, that after trying out many cleaners over a period of many weeks, they found the No. 65 cleaner, of the International Chemical Company of Philadelphia, Pa., being entirely soluble, would do the work for them and they now use this compound at the rate of 10,000 pounds per year.

When the solution is first mixed, 7 ounces of this cleaner are dissolved in each gallon of hot water. Additions are made regularly, of course, and 225 pounds of cleaner are used each week to clean 80,600 pieces, weighing in all 86,515 pounds. At the end of two weeks it is necessary to drain the cleaning tanks and to remove the sediment which has settled on the bottom. All work except screws comes from the machines free from oil. Screws and lockwashers are made of steel, all other parts being brass. Valves are set into the cleaning tank in small baskets and are allowed to remain there five minutes. To remove small particles of metal, they are brushed with water on revolving Tampico brushes before plating. They are then plated and washed in cold and then hot water.

Screws covered with oil from the screw machines are dipped into the same solution of No. 65 cleaner for five minutes, given a bath in muriatic acid to remove rust, and then rinsed in hot water and a weak cyanide solution to neutralize the acid and prevent rust. Screws are put into a mechanical plating barrel which plates and polishes them simultaneously, rinsed in cold water, then hot water and then dried in sawdust in a tumbling barrel.

The cost of the cleaner is 26.5c per 1,000 pieces, or 24.7c per 1,000 pounds.

NEW FIRE EXTINGUISHER

The Bastian-Blessing Company, 240 E. Ontario street, Chicago, Ill., is bringing out a new machine for stopping fires, which is said to be much more effective than anything now in use. It is also stated that it will absolutely not damage anything except the fire. It can be used in the most complicated machinery or upon the most delicate fabrics without injury.

REGO FIRE STOPPER

The Rego Fire Stopper is composed of two main units, a cone-shaped container which is full of dry powder and a small tank which is filled with CO_2 gas under pressure. When a fire is discovered the machine is turned upside down, the valve on the gas tank opened, and the resulting stream of powder directed at the base of the flame. When the fire is out, the valve is closed and the tank returned to an upright position. Only as much powder as is actually necessary to put out the flame is used.

The principle upon which the Rego Fire Stopper works is that the powder, when coming in contact with the flame, generates CO_2 gas, which immediately blankets the entire fire and effectively smothers the flame. The use of CO_2 for power gives the machine an effective range of from 25 to 30 feet.

Equipment and Supply Catalogs

Refractory Cements. Norton Company, Worcester, Mass.

Spray-Finishing System. The DeVilbiss Company, Toledo, Ohio.

Squirrel Cage Motors. General Electric Company, Schenectady, N. Y.

Refractory Gun. Quigley Furnace Specialties Company, New York.

Home Ventilating Fans. American Blower Company, Detroit, Mich.

Temperature Recorder. Charles Engelhard, Inc., 30 Church street, New York.

Sand Blast Equipment. Ruemelin Manufacturing Company, Minneapolis, Minn.

Weather Forecasts—for the golfing season only. Harding Company, New York.

Industrial Gases. A broadside from the Air Reduction Sales Company, New York.

Hytempite in the Foundry. Quigley Furnace Specialties Company, New York.

Automatic Presses for Small Parts. Baird Machine Company, Bridgeport, Conn.

Wound Rotor Induction Motors. General Electric Company, Schenectady, N. Y.

General Purpose Synchronous Motors. General Electric Company, Schenectady, N. Y.

Trulime. A Vienna Lime Composition. Hanson and Van Winkle Company, Newark, N. J.

Resistance Thermometers. Catalog No. 92. Brown Instrument Company, Philadelphia, Pa.

Self-Sustaining Galvanizing Solution. Meaker Galvanizing Company, 1249 Fulton street, Chicago, Ill.

Functions of the Controller. Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York.

Facts for Foundrymen. E. G. Jarvis, president Niagara Falls Smelting and Refining Corporation, Buffalo, N. Y.

First Aid Rooms in Small Plants. Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York.

Instructions for the Installation and Care of Thermo-Electric Pyrometers. Brown Instrument Company, Philadelphia, Pa.

Putting the Factory Employees on the Sales Staff. By John F. Sherman, president the Sherman Corporation, Engineers, New York.

Pumps for tires, footballs, basketballs, punching bags, pressure lamps, oil and grease guns, hub caps, etc. Bridgeport Brass Company, Bridgeport, Conn.

Electric Controlling Apparatus. Allen-Bradley Company, Milwaukee, Wis. Folders to be bound together covering Accessories, Automatic Starters, Manual Starters, Rheostats, Mill and Crane Controllers.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS, 140 SOUTH DEARBORN STREET, CHICAGO, ILL.

NEW SPECIFICATIONS PROPOSED FOR NON-FERROUS METALS

F. L. Wolf, the A. F. A. representative on sub-committee III of the A. S. T. M. Committee B-2, which originates specifications for sand cast metals and alloys, reports that four new tentative standard specifications for sand cast non-ferrous metals have been proposed for consideration. The specifications are to cover:

1. Aluminum bronze castings.
2. Steam or valve bronze.
3. Composition brass or ounce metal.
4. Alloy 88 copper—8 tin—4 zinc.

The sub-committee also is proposing a method for the determination of aluminum in brass and bronze, a specification for aluminum base sand casting alloy ingot and suggests a change in the present tentative method for chemical analysis of aluminum and light aluminum alloys.

The four proposed tentative standard specifications for sand cast metals provide directions and specifications for

a. Manufacture.
b. Chemical properties and tests.
c. Physical properties and tests.
d. Inspection and rejection.

The proposed tensile properties of aluminum bronze castings are shown in Table 1.

Tension	Grade A	Grade B
Minimum ultimate tensile strength lb. per sq. inch (as cast)	65,000	65,000
Minimum ultimate strength lb. per sq. inch (as heat treated, quenched and drawn)	.....	80,000
Minimum yield point (as cast)	25,000	25,000
Minimum yield point (as heat treated)	.....	50,000
Minimum per cent elongation in 2 inches (as cast)	20	15
Minimum per cent elongation in 2 inches (as heat treated)	.....	4

The proposed tensile properties of steam or valve bronze are as follows:

Minimum ultimate tensile strength lbs. per sq. inch	32,000
Minimum yield point	16,000
Elongation in 2 inches	17

The proposed tensile properties for composition or ounce metal are as follows:

Minimum ultimate tensile strength, lbs. per sq. inch	26,000
Minimum yield point	12,000
Per cent elongation in 2 inches	15

The proposed tensile properties for alloy 88 copper—8 tin—4 zinc are as follows:

Minimum ultimate tensile strength, lbs. per sq. inch	40,000
Minimum yield point, lbs. per sq. inch	15,000
Per cent elongation in 2 inches	20

All members of the A. F. A. interested in these specifications are requested to communicate with F. L. Wolf, Ohio Brass Company, Mansfield, Ohio.

BRASS MANUFACTURERS' ASSOCIATION

HEADQUARTERS, CITY HALL SQUARE BUILDING, CHICAGO, ILL.

The National Association of Brass Manufacturers' concluded a very interesting three days' session at their spring meeting held at the West Baden Springs Hotel, West Baden, Ind., on Friday, March 26.

The first day's session was given over to the committee working on the new official catalogue which will be issued on January 1, 1927, the lists in which will be entirely different from that of any catalogue ever published before, and placed on a much lower basis in order to get away from the high, useless and factitious discount that has applied to the brass goods business for more than a generation.

A little booklet gotten out by the National Association of Brass Manufacturers on the matter of installation and proper method of caring for plumbers' brass goods was presented, and report made that the first edition of 50,000 had been practically exhausted, a copy being mailed to all the plumbers and many journeymen. The feeling was that an addition supply would be required with a view, not so much of advertising, but of educating and putting a copy in the hands of the contracting plumber, but more particularly, in the hands of the journeymen.

The convention recommended and ordered the packing of bath faucets with their respective type of couplings separately, rather than complete and in combination, with a view of economy to both manufacturers and jobbers, as it simplifies stock and reduces inventory investments, and one type of bath faucet can be supplied with a variety of couplings.

Curtain rods for showers should be placed 6 feet 4 inches from the floor and substantial batten or other provisions made by the contractor to securely hold the screws of these rods.

At the closing of the convention, Commissioner Webster treated the association to somewhat of a surprise with the statement that he had carried the banner now for almost a generation, and at the end of next year's session in 1927 he would then have served the association for twenty-five years, and stated, if it was the wish then that he be relieved from further service that that would be entirely satisfactory to him.

The next meeting of the association will be held June 29 and 30, Chicago, Ill.

METAL TRADES ASSOCIATION

HEADQUARTERS, PEOPLES GAS BLDG., CHICAGO, ILL.

The Twenty-eighth Annual Convention of the National Metal Trades Association was held at the Hotel Astor, New York, April 15-16, 1926. Committees reported on Industrial Relations, Prevention of Accidents, Industrial Education and Training Foremen. A number of papers were read and addresses delivered by persons of prominence.

AMERICAN ZINC INSTITUTE

HEADQUARTERS, 27 CEDAR STREET, NEW YORK

All officers of the American Zinc Institute were re-elected at the annual convention in St. Louis, Mo., April, 20, 1926. They are: A. H. Cobb of New York, president; Stephen S. Tuthill of New York, first vice-president; Howard Young of Mascot, Tenn., treasurer, and Arthur E. Bendelari, Chicago; Jesse G. Starr, Joplin, and John A. McCarthy, New York, vice-presidents. All eight directors were re-elected except Charles W. Baker of New York, who was replaced by Mr. Young.

AMERICAN ELECTRO-PLATERS' SOCIETY

NEWARK BRANCH

HEADQUARTERS, CARE OF ROYAL F. CLARK, 55 SEYMOUR AVE.

The auditorium of Salaam Temple, located underneath the Mosque Theatre, at 1013 Broad street, Newark, has been selected as the place for holding the fourteenth annual convention of the American Electro-Platers' Society which will start on June 28 and continue until July 1, 1926.

Horace H. Smith, chairman of the committee of Newark Branch having the arrangements for the convention in charge, closed the arrangements for the auditorium, its adjoining committee rooms and exhibition space, a few days ago. The auditorium has a seating capacity of approximately 1,500 persons. The exhibition hall will be divided into about thirty spaces of which about twenty are already taken.

Plans for housing the more than 500 delegates expected to the four-day session are also practically complete. Newark Lodge of Elks, whose home is only a block away, will provide fifty rooms for the delegates and give them the freedom of the fourteen-story building, with its lounges, pool and billiard rooms, restaurant, swimming pool and gymnasium. The Robert Treat Hotel will place eighty double and forty-five single rooms at the disposal of the committee and the Hotel Riveria will have 125 rooms available. Other hotels of the city will also have rooms available.

The tentative program is being whipped into shape, a cursory view indicating that the visitors will have both an educational and enjoyable time. As usual at conventions the morning of June 28 will be devoted to registration and to giving the visitors an opportunity to renew old acquaintances and make new ones.

The formal opening of the convention will take place at the afternoon session when Mr. Smith, who is connected with Tiffany & Company, manufacturing jewelers of Newark, will give a brief address of welcome and turn the convention over to the officers.

Educational papers will feature the evening session of that day and the morning session of the following day, Tuesday. On Tuesday afternoon from 1:30 to 3, there will be other papers and discussions. From 3 to 6 the delegates will inspect the plant of the Hanson-Van Winkle Company in Oliver street, Newark. Papers and discussions will feature the evening session of that day. On Wednesday morning, the delegates will get an early start for a visit to the Raritan Copper Works at Perth Amboy. At the same time the ladies will be sent by bus or train to Asbury Park for a day's outing at the seashore. In the afternoon the men will visit the A. P. Munning plant at Matawan. Whether there will be an evening session will depend on what time the delegates arrive back in Newark.

The Thursday morning session will be featured by the election of officers and a decision as to where the 1927 convention is to be held, together with such other business as may come before the convention. In the afternoon, time will be taken off for play. The Essex County Park Commission will be asked to allow the use of Weequahic Park, one of the chain of Essex County parks, for a baseball game between the Eastern and Western delegates and for tennis, boating and athletic events.

The convention will come to a close with a banquet on Thursday night at which prominent state and city officials and men prominent in the electro-plating industry will speak. There will also be a vaudeville show and dancing.

Wives and other relatives of the members of the Newark Society committee have formed themselves into a Ladies' Auxiliary to aid in entertaining the women who come with the delegates. Included in this auxiliary are Mrs. Horace H. Smith, Mrs. Oliver Sizelove, Mrs. George Hogaboom, Mrs. Samuel Taylor, Mrs. F. W. Matts, Mrs. Philip Sievering, Mrs. George Reuter, Mrs. William DeVoti, Mrs. Peter Labash, Mrs. S. Glickenhaus, Mrs. Charles Bohler, Mrs. George Conley, Mrs. A. C. Calabrese, Mrs. Fred Gumm, Mrs. Harty McGovern, Mrs. Conrad Frey, Mrs. J. A. Weiss, Mrs. W. L. Hults, Mrs. Roy Stout, Mrs. George Onkson, Mrs. Henry Bergfels, Mrs. Edward Faint, Mrs. C. H. Koop, Mrs. L. T. Dondi.

OLIVER SIZELOVE HONORED

Nineteen of a class of twenty-one foremen in electro-plating departments of concerns in Newark and vicinity have received certificates for completing a two years' course in chemistry at the Essex County Vocational School. The other two were unable to complete their course because of having removed from the city after changing business connections. A second class of foremen have completed one year's studies and will graduate a year from now.

FOREMEN'S CLASS IN ANALYSIS OF PLATING SOLUTIONS.

All the foremen students are members of Newark Branch, American Electro-Plater's Society.

On March 29, 1926, the members of the school and the Newark Branch gave a testimonial dinner in honor of Oliver Sizelove, in recognition of his services to them. Robert S. Beebe, director of the school presided. Mr. Sizelove was presented with some pieces of sterling silverware to complete a service of which he already had part.

The first year of the course is given over to solution making and its qualitative analysis. **Samuel P. Taylor,** foreman of the plating and etching department of the **Gorham Manufacturing Company,** was the teacher. The second year course consists of volumetric analysis of the various solutions, considered an essential for the successful foreman electro-plater. The teacher of the second year course is **Oliver J. Sizelove,** foreman in the electro-plating department of **August Goertz & Company.** The latter is a graduate of a four-year course in applied chemistry at the Newark Technical School.

Discussing the technical end of the business, Mr. Sizelove, who also is chairman of the educational committee of the Newark Branch of the American Electro-Platers' Society, said that during the last few years chemistry has played a great part in the successful electro deposition of metals. The plater who has been able to control his solution by chemical analysis has a decided advantage over his less fortunate fellow-worker. He predicted that this technical knowledge would be more and more required as time went on and that every plater must be able to control his solution by analysis or give way to those who could.

Addresses were made by George Reuter and G. B. Hogaboom. A letter of congratulation was received from George Gebling of Philadelphia.

BRIDGEPORT, CONN.

HEADQUARTERS, R. J. O'CONNOR, 1228 NOBLE AVENUE,

The Bridgeport Branch held its 8th annual banquet at the Stratfield Hotel, Bridgeport, on Saturday, April 24th, 1926. The attendance totalled over 125, and a very fine educational meeting was held. The program, which was presided over by R. J. O'Connor in the absence of Charles H. Proctor, Founder of the Society and Plating-Chemical Editor of THE METAL INDUSTRY, was as follows: Polishing and Buffing Practice, by B. H. Divine; Finishing Soft Metal Novelties, by O. J. Sizelove; Electro-Plating Research, by John L. Christie; The Ammeter, by C. S. Barbour; The Newark Convention, by Horace Smith; History of Copper from Mine to Consumer, by S. Skowronski. Among the guests was George Gehling of Philadelphia.

Music was furnished for the banquet by the Pequonnock Orchestra, and between the extraordinarily fine menu and the excellent entertainment, a most enjoyable evening was provided. The banquet committee consisted of the following: R. J. O'Connor, chairman; Wm. Thompson, Frank Spaine, Geo. Belle, Wm. Stratton, J. C. Oberender, Geo. Karl, Nelson Barnard.

AMERICAN ELECTROCHEMICAL SOCIETY

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK

At the annual business meeting which was held, April 23, 1926, in Chicago, Ill., the following officers were elected:

President, one year: Dr. William Blum, United States Bureau of Standards, Washington.

Vice-presidents, two years: Dr. Paul D. Merica, International Nickel Company, New York; Prof. Bradley Stoughton, Lehigh University, Bethlehem, Pa.; Prof. O. P. Watts, University of Wisconsin, Madison, Wis.

Managers, two years: William G. Harvey, American Magnesium Corporation, Niagara Falls, N. Y.; Dr. B. D. Saklatwalla, Vanadium Corporation of America, Bridgeville, Pa.; George B. Hogaboom, Hanson & Van Winkle, Newark, N. J.

Treasurer: Acheson Smith, vice-president, Acheson Graphite Company, Niagara Falls, N. Y.

Secretary: Dr. Colin G. Fink, Columbia University, N. Y.

CHEMICAL EQUIPMENT MANUFACTURERS

HEADQUARTERS, 1328 BROADWAY, NEW YORK

The Association of Chemical Equipment Manufacturers, Inc., will hold an exposition in Cleveland, Ohio, May 10-15, 1926. This exposition will cover equipment and processes in the chemical industry, in which metals play a very important part.

BRITISH INSTITUTE OF METALS

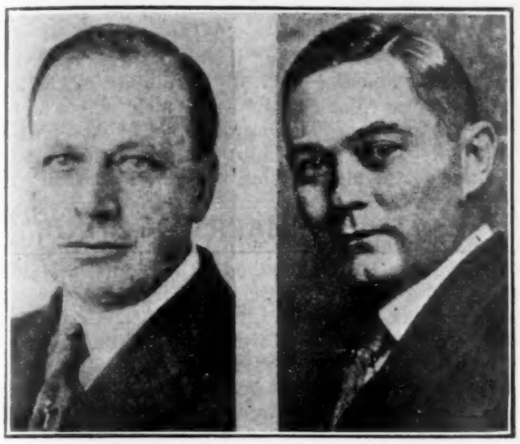
HEADQUARTERS, 36 VICTORIA STREET, WESTMINSTER, LONDON S. W. 1, ENGLAND

A general meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W. 1, on Wednesday, May 19, 1926, at 8 p. m. Professor H. C. H. Carpenter will deliver the sixteenth annual May lecture on "Single Crystals and Their Properties."

Personals

NEW BRIDGEPORT BRASS DIRECTORS

At a meeting of the Bridgeport Brass Company, Bridgeport, Conn., held Tuesday afternoon, February 23, 1926, Warren D. Blatz, general sales manager, and Walter R. Clark, general works manager, were appointed to the Board of Didectors. The selection of the two men as directors is in pub ic recognition of their ability and rapid rise in the ranks of chief executives of the firm.



WALTER R. CLARK WARREN D. BLATZ

WARREN D. BLATZ

Warren D. Blatz, the son of a Methodist minister, was born in Brooklyn, N. Y.

He attended seven different grammar schools in seven different cities, because he was forced to move about, as Methodist ministers' families do, and he finally arrived in Westville, Conn., where he attended the Hillhouse High School in New Haven. He was later transferred, and was graduated from the Boardman Manual Training High School in New Haven in 1901. The Blatz family then moved to Southhampton, Long Island, where Mr. Blatz took a two years' post-graduate course in higher mathematics.

In 1905 he came to Bridgeport and obtained a job at the T. L. Watson Company as junior clerk, with a salary of $6.00 a week, with the intent to earn money enough to get further schooling in the fall. He liked the work and remained with them for twelve years, leaving them in 1916 to join the organization of the Bridgeport Brass Company, at which time Guy P. Miller was general manager.

His work has always been in the sales department starting first in the manufacturing end and then specializing in phono-electric. He has worked on practically every desk job in the sales department, and five years ago was made sales manager of the mill products division. About three years ago he was made general sales manager, and since that time has tried to sell practically all of our products in almost every State in the Union.

His hobby is outdoor life, consisting principally of hunting and fishing.

He is affiliated with the Hamilton Commandery, Pyramid Temple Mystic Shrine, Corinthian Lodge 104, and is a member of the local Brooklawn and Algonquin clubs.

WALTER R. CLARK

Walter R. Clark was graduated from Yale (Sheffield School) Class of '99. In 1900 he started in as a draftsman in the Bridgeport Brass Company. He soon rose to be head draftsman and later was made chief engineer, which position he held until 1919, when the duties of works manager in the mill products division were added to his other duties. During this period the company expanded from its small size to its present place in the industry. Under his supervision the Housatonic plant was built. In 1921 he was made general works manager in charge of both divisions, which position he holds today.

ADAM WENDEL

Adam Wendel of Waterbury, superintendent of the Berbecker & Rowland Manufacturing Company, was given a dinner by the officials and employes of the plant at the company's club rooms in Waterbury, Conn., April 12, 1926, in celebration of the 50th anniversary of his connection with the company. He entered the employ of Julius Berbecker, founder of Berbecker & Rowland's in April 12, 1876. The company's plant was then in New York. It moved here in 1890 when it merged with the Tucker Manufacturing Company of this city.

W. J. Berbecker, vice-president of the company, and grandson of Julius Berbecker, who represents the sales office in New York, was present and spoke, as did L. W. Bond of the New York sales office. Herbert S. Rowland, treasurer and general manager, presented Mr. Wendell with a gold watch and chain from the directors of the corporation. Robert S. Booth, assistant treasurer, acted as master of ceremonies, and presented Mr. Wendel with a number of letters from the representatives of concerns who are acquainted with Mr. Wendel's achievements. Gifts from the Foremen's Association were presented by Joseph Muscio, its president and from the office employes of the company, by F. H. Raymond. Those present represented the officers and directors of the company, the sales organization, members of the office force, members of the Foremen's Association and all employes who have been in the service of the company for 10 years or more. Mr. Wendel, in expressing appreciation for the gifts, gave a history of the organization from the beginning.

B. W. Lattin, formerly with the D. J. Ryan Foundry Company and with the Ferro Enameling Company of Cleveland, Ohio, is now with Moore Bros. Company of Joliet, Illinois.

William M. Corse has been appointed a consulting metallurgist on the staff of the United States Bureau of Mines, Washington, D. C. He will serve the Bureau in connection with non-ferrous metallurgical research.

Clyde N. Thomas, who has been with Beach Foundry Company, Ltd., Ottawa, Ontario, and formerly with the Ferro Enameling Company at Cleveland, Ohio, is now with the Stanley Insulating Company, Inc., of Great Barrington, Mass.

William Westerman, general works manager of the Michigan Copper and Brass Company, Detroit, Mich., has just returned from a two months' trip to Europe. While there, Mr. Westerman visited the major copper and brass manufacturing plants in England, Holland, Germany and France.

W. F. Prince has recently been appointed equipment engineer for the J. W. Paxson Company, foundry equipment manufacturers, Philadelphia, Pa. Mr. Prince has had experience in brass and non-ferrous metal foundry practice for many years in the United States, and is well known in the trade. He will devote his time to consulting with foundry owners and executives in connection with foundry problems of every kind.

Charles H. Clark has recently been appointed raw material salesman for the Bridgeport Brass Company, Bridgeport, Conn., traveling the state of Massachusetts and the cities of Providence, R. I., and Meriden, Conn., for them. He comes to the Bridgeport Brass Company after being connected with John Tredennick, Inc., of Boston, Mass., wholesale coal dealers, for which concern he sold coal to the Bridgeport Brass Company.

Newton E. Dabolt, who for the past six years has been general sales manager in charge of sales for both the Lacquer and Leather Divisions of the Zapon Company, has announced his resignation. Mr. Dabolt is well known to manufacturers in the automotive, furniture and other industries which have been large users of Zapon products. While he has not definitely announced his future plans, Mr. Dabolt is severing his twelve-year connection in order that he may give personal business interests in Rochester, N. Y., his undivided attention.

Obituaries

JULIUS MALTBY

Julius Maltby of Waterbury, secretary of the Waterbury Buckle Company, died at St. Raphael's hospital, New Haven, Conn., April 11th, following an illness of months from intestinal troubles. He was 69 years of age. He was a member of one of the old Waterbury families and related to many of the founders of Waterbury brass industries.

His father was treasurer and manager of the Waterbury Button Company, a director of the Benedict & Burnham Company, and the founder of the Maltby, Curtiss & Company, which for several years operated a German silver plant. He was also connected with the Scoville Manufacturing Company. His mother was a member of the Somers family, which was prominent in the organization of many of the local plants and still active in control of the Waterbury Rolling Mills Company and Somers Manufacturing Company. One of his sisters is Mrs. Archer J. Smith, wife of the president and treasurer of the Waterbury Buckle Company and president of the American Rolling Mills Company.

He was born in Waterbury, Jan. 20, 1857, the son of Douglas F. and Mary Somers Maltby. He was first employed in his father's German silver concern but became secretary of the Waterbury Buckle Company in 1897 and held that position ever since. He is survived by his wife, Mrs. Harriet Fowler Maltby, daughter; Mrs. A. L. Kelley, of Providence, R. I., three sisters, Mrs. Archer Smith and Miss Cornelia Maltby of this city, and Mrs. Darwin Meserole of New York, and a brother, Henry Maltby of California.

JOHN G. TUTTLE

John G. Tuttle, aged 44, assistant manager of the Torrington branch of the American Brass Company, died March 22 at the Litchfield county hospital in Winsted, after a brief illness. Death followed an operation for appendicitis. Mr. Tuttle was a native and lifelong resident of Torrington, the family home being at 287 Main street. He was married on October 6, 1908, to Miss Hazel Burnett of Winsted, who survives. He also leaves a son, John; a daughter, Lucia; his father, Nathan A.; and a brother, Arthur F. Tuttle. The deceased entered the employ of the Coe Brass Company upon his graduation from the Torrington high school in 1901 and remained with that company until his death. For the past three years his headquarters had been in the main office building of the American Brass Company at Waterbury. Mr. Tuttle was a director and former president of the Torrington Musical Association and a member of the Torrington Club. He was widely known and esteemed and his sudden passing caused widespread sorrow.

ALLEN CHAMBERS McKINNIE

Allen Chambers McKinnie, died at his home in New Britain, Conn., following a long illness, on March 15. He was born at Fort Scott, Kan., September 16, 1875. Mr. McKinnie entered the employ of the Wyeth Hardware & Manufacturing Company, St. Joseph, Mo., as a boy, later was with the Simmons Hardware Company of St. Louis, and in 1897 became associated with the Stanley Works, New Britain, Conn., where he was sales manager at the time of his death.

WILLIAM HENRY McCARTY

William Henry McCarty, aged 84, a veteran of the civil war and for 25 years employed as a caster at the Torrington plant of the American Brass Company, died at his home in Torrington on March 26, 1926. He has been in failing health for some time.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

MAY 1, 1926.

Despite an indicated letting up in business at the beginning of last summer, before the summer was over the **American Brass Company** had the best period of its history and at the end of the year, had the largest year in its history, **John A. Coe,** president of the company, declared last week. In addition, the company had the best quarter in its history and the best month in its history for the month and quarter ending March 31, this year, he said:

"The present state of business does not indicate industrial recession and we are looking for a very good year," said **John D. Ryan,** chairman of the board of directors of the **Anaconda Company,** owner of the local concern. "Shipments by the American Brass Company in the first quarter of this year were the largest of any quarter in its history and were 12½ per cent more than that of the same period of 1925. Orders and contracts on hand at the end of the quarter are 13 per cent in excess of those at the same date last year. The year 1925 was the greatest year in the company's history in shipments and orders taken.

The industrial employment bulletin of the Department of Labor for the past month says of Waterbury: "Industrial employment conditions here continue to improve. All plants are operating full time and there is very little unemployment apparent. Shortage of skilled labor is reported. Overtime schedules obtain in the tube mills."

Charles F. Brooker, chairman of the board of directors of the **American Brass Company,** who has been sojourning in Florida for nearly two months, has returned to his home in Ansonia. His health was not of the best at the time he went South, due to illness contracted while on a trip to Porto Rico, but he is now very much improved.

E. O. Goss, president of the **Scovill Manufacturing Company,** as chairman of the power committee of the New England Council, recommended at the meeting of the council at Portland, Me., last month, the inter-connection of water power systems throughout New England in the interests of economy and to secure maximum utilization of water powers. The resolution recommended by Mr. Goss, strikes a direct blow at the policy of the state of Maine to forbid the export of power.

John A. Coe, president of the **American Brass Company,** is a member of the general committee in charge of arrangements for the New England Foreign Trade Conference which will be held in Boston, May 26th and 27th, for the purpose of solving problems facing importers and exporters. Representatives from many local concerns are planning to attend the conference which is to be held under the auspices of the Boston Chamber of Commerce.

Two Waterbury men have been appointed to the traffic committee of the Manufacturers' Association of Connecticut. They are: **P. W. Brown,** traffic manager of the **Chase Companies, Inc.,** and **J. D. Heffernan,** traffic manager of the **Scovill Manufacturing Company.**

William B. Price, metallurgist of the **Scovill Manufacturing Company,** gave an illustrated lecture on "Application of Technical Control in the Brass Industry," at the local Kiwanis' meeting, last week. The speaker explained the uses of chemistry and metallurgy in industry and showed slides demonstrating the differences in crystal structure of various cupro-alloys under different physical conditions.

Frederick W. Holcomb, who is connected with the Scovill **Manufacturing Company,** was elected president of the **Doolittle Box Company, of Meriden,** last month, succeeding his father-in-law, **Edgar J. Doolittle,** who founded the business 60 years ago. He will retain his residence here and connection with the Scovill Company.

Thefts of copper from the **Chase Companies, Inc.,** have been

investigated by the local detective bureau and stopped with the arrest of two boys who have been in the habit of "hopping" the trainloads of copper which are moved by the company's engine over from its Waterville plant to its North Main street plant. When the train reached the woods between the two plants, the boys would throw off quantities of copper and later pick them up.—W. R. B.

BRIDGEPORT, CONN.

May 1, 1926.

All industries are running nearly to full capacity in Bridgeport, according to the last industrial employment bulletin issued by the United States Department of Labor, which states: "All factories are not using practically full quotas. There is a shortage of skilled craftsmen reported. Overtime obtains in many of the metal working plants."

For the purpose of transporting by air, officials and small freight of the **General Electric Company,** from the Bridgeport plant to the other plants of the company about the East, the **Nutmeg Flying Company** has been chartered by the state. Its incorporators are **Oscar F. Kraus** and **Frank T. Healey** of Waterbury. The General Electric Company has many rush orders for small parts which are needed immediately for breakdown jobs in various parts of the East. Its officials are also required to make hurried trips between various of its plants, including the Bridgeport, Springfield, Schenectady and others.

The **Bridgeport Brass Company** has awarded prizes to pupils of the art class in Bridgeport High School for coloring the firm's series of six historical advertisements. Miss Josephine Bell was given first prize of $5; Miss Dorothy Turner, second prize, $3; and Miss Ethel Nestor, third prize, $2. The remainder of the $20 donated by the company is to be used in buying supplies for the art department. Thirty-eight pupils participated.

Its appeal for assessment reduction having been denied by the board of relief, the **Crane Company** has applied to the Supreme Court for redress. It is asked that the total valuation be changed from $4,297,446 to $3,447,094, a decrease of $850,352. The appeal is taken principally on the assessment levied against machinery, equipment and inventory of the company, on which items a reduction of $732,208 is sought from the assessment of $2,683,753.

Waldo C. Bryant, president of the **Bryant Electric Company,** is on the general committee in charge of arrangements for the New England Foreign Trade Conference which will be held in Boston, May 26th and 27th, for the purpose of solving problems facing importers and exporters.

W. H. Pease, traffic manager of the **Bridgeport Brass Company,** has been named to the traffic committee of the **Manufacturers' Association of Connecticut. Raymond L. French,** of this city, is chairman of the committee. The committee will study problems in transportation and shipping which could not otherwise be handled without personal interviews by the representatives of the manufacturers.

The plant at 938 Crescent avenue, occupied during wartime by the **Stanley Works, Inc.,** has been purchased for an amount said to be about $100,000 by the **Tell-Tone Manufacturing Company.** The building is three stories, of brick and has 33,000 square feet of available factory space. The new concern manufactures machine tools and has patents pending on a machine which it intends to manufacture, the nature of which has not been described.—W. R. B.

TORRINGTON, CONN.

May 1, 1926.

Some departments of Torrington shops are working on slightly curtailed schedules but the general impression is that this lull in activities is only temporary and that full time schedules will be in order before the end of the spring season.

Work has been started on a $50,000 addition to the plant of the **Progressive Manufacturing Company.** The addition will be used for storage, shipping and special manufacturing purposes. It will be of modern type, brick construction, one-story high with basement, 140 feet deep and 80 feet in width at its widest point. It will stand south of the present factory buildings. The architect is William E. Hunt and the contractor the Torrington Building Company.

The big three-story addition to the plant of the **Hotchkiss Brothers Company** is nearing completion.

In addition to the factory building mentioned above, construction work is in progress on the new trade school building, on an addition to the postoffice and on a new schoolhouse in the Drakeville section of the town.

Charles F. Brooker, who was a director of the Torrington Water Company from the time of its organization in 1878, resigned from the board at the annual meeting held recently. The resignation came unexpectedly, though it was known that Mr. Brooker's health was such as to make it advisable for him to curtail some of his many business activities. **Frank R. Appelt** was elected to succeed him.—J. H. T.

NEW BRITAIN, CONN.

May 1, 1926.

The middle of spring finds conditions in the metal manufacturing trades in New Britain as good as anywhere in the East and better than many places. Although the backward spring season has had some effect on the market, it has not been enough to cause any appreciable slump and the demand for builders' hardware, such as local concerns turn out, is brisk. There is a specially good demand for hardware trimmings, locks and similar articles used in the finishing of homes and apartment houses.

The electrical appliance trade continues good, reports from **Landers, Frary & Clark** indicate. Although the **North & Judd Manufacturing Company** cut their usual dividend at the recent meeting, no apprehension is felt about the condition of the firm. This cut was due, it was explained, to the unusual heavy losses occasioned in the collapse of the annealing building in the foundry branch last February.

The **American Hardware Corporation,** in all its branches, continues as usual and other smaller concerns report a good spring business.

The **Landers, Frary & Clark** have just placed a contract with the **Morton C. Tuttle Company** of Boston for the construction of a reinforced concrete building 60 ft. x 260 ft. and six stories high; a wing 60 ft. x 60 ft. and an overhead bridge between. Another one story building, 60 ft. x 260 ft. also is to be built.—H. R. J.

PROVIDENCE, R. I.

May 1, 1926.

The close of the first four months of the year finds a decidedly more cheerful atmosphere prevailing in practically every industrial and mechanical line. Business men have been optimistic all the time but the present optimism is of a more material character than has prevailed heretofore. There has been no boom in any one of the metal lines and none is looked for, but on the whole there has been an improvement that it is believed will be continued. This is especially true with regard to the jewelry lines.

Rathburn Willard, head of the **General Plate Company** of Attleboro, announced a few days ago that following several weeks of contemplating and negotiation for a site, the firm had decided to erect its own factory and will shortly start upon a two-story building that will be approximately 215 ft. x 50 ft.

The **Gorham Manufacturing Company** reports a net profit amounting to $591,202 after all taxes and depreciation for the year ending Jan. 31, 1926, were paid. The annual report was made public on April 14 and shows profit and loss surplus amounting to $917,104 on Jan. 31 as compared with $325,902 on the corresponding date a year ago.

At a meeting of the directorate held immediately following the stockholders' meeting the following were elected as the officers of the corporation for the ensuing year: Chairman, **Henry J. Fuller;** President, **Edmund C.** Mayo; first vice-president, **Alfred K. Potter;** second vice-president, **John B. Abbott;** secretary, **Hiram C. Hoyt;** assistant secretary, **Albert A. Wainwright;** treasurer, **Alfred K. Potter;** assistant treasurer, **Lester F. Morse.**

The **Doran Automatic Device Company** is the name of a new firm that has recently started in business at 150 Chestnut street. **James A. Doran,** of the **James C. Doran & Sons Company,** manufacturing jewelers, is the owner.

The **Protgen Company,** manufacturers of lacquers and chemicals for the jewelry trade, is the name of a new concern that has recently started in business at East Providence. The owners of the new firm are **Harry Howard and Frank McCarthy.**

The **Rhode Island Wire Works, Inc.,** 45 Willard avenue, has the contract for eight elevator fronts in the Bodell building on Custom House street, to be of bronze.—W. H. M.

MIDDLE ATLANTIC STATES

ROCHESTER, N. Y.

MAY 1, 1926.

The industrial situation in Rochester appears to have undergone very little change during the past month, with but one exception. Business is much better among the brass foundries and electro-plating plants about the city. Reports received today from superintendents of several local plants were to the effect that all Rochester foundries were operating at nearly normal and that every worker in the city was employed.

Inquiry among the larger manufacturing plants about town reveals the fact that a feeling of optimism prevails. Most concerns are operating at higher speed and their output is much larger than earlier in the year. The falling off in February and early part of March has been overcome in most plants, and it is thought that a busy season will continue well into June.

No new enterprises are in prospect just now, according to information obtaining from the Industries Section of the Rochester Chamber of Commerce.—G. B. E.

NEWARK, N. J.

MAY 1, 1926.

Vice Chancellor Backes has appointed **Milton M. Unger** as receiver for the **Essex Clipper & Tool Company,** 3438 Littleton avenue. The appointment was made on the application of Michael M. Sheedy, secretary-treasurer of the company, with a claim of $2,800. The company was incorporated in September, 1922. The company has assets of $24,440, while its liabilities are $17,000, but the concern lacks cash with which to continue business. The plant has been shut down for some time.

The **Savage Hardware & Supply Company,** Kearny, N. J., has secured an order from Vice Chancellor Bentley requiring **Herman Pintell** to show cause why he should not be restrained from acting as treasurer of the company. Mr. Pintell was replaced after he was found to be giving unsatisfactory service and a new treasurer elected, the bill of complaint sets forth. Despite the firm's protests Pintell continued to act as treasurer.

As soon as preparations are completed at the Matawan, N. J., plant of the **Metallugical & Chemical Corporation,** experiments will begin on the smelting of antimony. Already fifty tons of ore have been purchased from South America. The experiments will be conducted on a practical scale to determine the feasibility of handling this material. Twenty-five tons of tin were smelted recently. New tuyeres have been installed in the thirty-six inch blast furnace, thus eliminating the old rectangular bustle.

Following Newark concerns have been incorporated: **Newark Screw Products Company,** manufacture screws, 2,500 shares; **Solderite, Inc.,** soldering, $25,000; **Newark Pattern Works,** castings, $125,000; **B. & R. Brass Foundry,** manufacture brass, $125,000; **New Jersey Jewelers' Supply House,** jewelry, $125,000; **Pneumatic Ejectors,** machinery, $75,000.—C. A. L.

TRENTON, N. J.

MAY 1, 1926.

Plans for a group of majority security holders of the **J. L. Mott Company,** local manufacturers of plumbing fixtures and supplies, to settle financial difficulties of the firm that placed it in the hands of receivers on June 28, 1924, and thus again to secure control of and reorganize the concern, were made public in New York City recently by Herbert Noble, counsel for the group.

Provision has been made for the retirement of the $2,000,000 bond issue which matures in June, and an addition of more than $1,000,000 in fresh capital will be made by a financial group which has been interested in the concern, according to the announcement.

Matthew Scammell, of Bellevue avenue, Trenton, member of the Scammell China Company here, is one of the interested group. Mr. Scammell asserted that arrangements would likely be made for settling also $700,000 worth of general merchandise claims held by creditors of the Mott firm.

Charles H. Baker and **Robert K. Bowman,** of Trenton, are receivers for the concern. They have been successfully operating it and upon their application to the United States Court here recently, Judge Bodine allowed a rule to show cause why the Mott Company should not be sold as a going concern. The rule is answerable by stockholders and creditors in the court at Newark on April 26.

Mr. Baker stated that the receivers had no offers officially from the security holders, creditors or other persons for either resuming control of or purchasing the Mott Company. Mr. Scammell declined to say whether the plans described by Attorney Noble would be ready for action by April 26, when the court rule is returnable. Mr. Baker said that any program for the receivers to turn over the company to purchasers or others must first be approved by the court, providing the permission is granted after April 26 for the receivers to dispose of the industry as a going concern.

Among those who are participating in the reorganization besides Mr. Scammell, are **Mrs. Charles A. McLean,** widow of Supreme Court Justice McLean; **Sir Ashley Sparks,** American managing director of the Cunard Line; **James H. Post,** president of the National Sugar Refining Company, and **Frederick S. Brackall,** general manager of the Taft-Pierce Company, of Woonsocket, R. I.

The J. L. Mott Company, organized more than 100 years ago by Jordan L. Mott, for years occupied a landmark in the Bronx, New York. The firm now has two plants at Trenton, N. J., with an annual payroll of $3,000,000 and controls the Mott Southern Company, of Atlanta, Ga., a sales organization.

The Carnegie estate holds $1,000,000, Jordan L. Mott, 2nd, $300,000, and Mrs. McLean, $700,000, of the $2,000,000 bond issue which falls due this summer. Mrs. McLean also holds $900,000 in preferred stock and 12,000 shares of common stock. In addition to the maturing bond issue the company owes $1,000,000 in obligations held by New York banks, while general merchandise creditors hold claims of $700,000. Indebtedness for current bills is placed at $300,000.

Capital stock outstanding of the Mott Company comprises 9,651 preferred and 26,941 common. The Tottenville (S. I.) Copper Company, Inc., was complainant in the receivership.

Following concerns have been chartered at Trenton: **Star Engineering Company, Inc.,** Arlington, N. J., manufacture electrical equipment, $10,000; **Radio Research Laboratories of New Jersey,** Asbury Park, manufacture radio supplies, 250 shares; **Gerard-Farenholz, Inc.,** Fairview, manufacture chemicals, $2,000; **Acme Hardware Company,** Trenton, N. J., hardware, 100 shares; **Ideal Trading Corporation,** Union City, manufacture electrical motors, $98,000.—C. A. L.

PITTSBURGH, PA.

MAY 1, 1926.

Industrial lines do not show much change in operations, although some concerns report a slight falling off in new business.

At the last meeting of the Science Club of Westinghouse High School, **John Stubbs** demonstrated how colloidial gold, copper and arsenic can be made. His demonstration was illustrated by samples he had prepared in the laboratory.

By means of a glass tube about a meter long and five centimeters diameter, **Earl Clement** illustrated rate of gas diffusion, using hydrochloric acid and ammonia gases. When the gases met in the center of the tube or near that point, a thin white disk of ammonium chloride made it possible to measure the diffusion rate.

Using silver nitrate in a caustic soda solution and sugar as a reducing agent, **Frank Patterson** illustrated the method of silvering mirrors.

Sales of **Aluminum Company of America** were in good volume in the first three months of 1926, and an official expects satisfactory results to continue during the next few months. Use of aluminum in the manufacture of furniture is developing rapidly. Production of aluminum probably will be started at the new Saguenay plant in Canada in the latter part of this year. Electric power will be purchased, at first, but the company's own water power rights at this point ultimately will be developed to take care of all requirements. Extensive construction in Canada eventually will take place as described on page 215 of this issue.—H. W. R.

MIDDLE WESTERN STATES

CHICAGO, ILL.

May 1, 1926.

The **Columbia Vari-Speed Company,** 4020 West Lake street, has been incorporated with a capital of 200 shares of no par value to engage and conduct a general manufacturing and sales business in machinery, parts, apparatus, devices. The incorporators are: Richard H. Jacobsen, Maurice D. French and Herman Schlotthauser. Correspondent, Samuel H. Gilbert, 77 West Washington street.

The **Borg-Greenleaf Corporation,** 4450 Ravenswood avenue, has been incorporated with a capital of $100,000 to manufacture and deal in electric clocks and time measuring mechanisms. Incorporators are: George W. Borg, Effie W. Borg and W. H. Greenleaf. Correspondent, Kenworthy, Dietz, Shallberg, Harper & Sinnett, People's Bank building, Moline.

The **Evans Flexible Reamer Corporation,** 5665 West Madison street, has been incorporated with a capital of $25,000 to manufacture and deal in tools, automotive equipment and accessories. The incorporators are: William J. McKillip, William J. McKillip, Jr., Vincent J. McKillip, William H. Evans and Lillian McQuillan. Max Zebel, Monadnock Block, is the correspondent.

Francis K. Bridgman, Inc., 4436 Woodlawn avenue, has been incorporated with a capital of 200 shares of no par value, to own and operate a radio broadcasting station or stations and to manufacture and deal in radio apparatus. The incorporators are: Francis K. Bridgman, Robert M. Arnold and Horace S. Kehm. Correspondent, Thompson, Thyrrell & Chambers, 10 North Clark street.

St. Joseph Company, Inc., 219 West Chicago avenue, has been incorporated with a capital of $25,000 to manufacture and deal in automobile and truck accessories and parts. The incorporators are: R. S. Tuthill, Harold A. Smith and M. E. Burgess. Correspondent, Winston, Strawn & Shaw, First National Bank building.

The **Reichmann Company** has changed its name to the **Thoradio, Inc.**

The **Burlington Watch Company** has decreased its capital stock from $250,000 to $200,000.

The **West Towns Auto Parts Company,** Wheaton, has been incorporated to manufacture, deal in and repair automobiles, tractors, machinery, parts, etc. The incorporators are: Clarence V. Wageman, Herbert C. Wehling and Richard B. Wehling. Correspondent, Joseph A. Reuss, Naperville.

The **Superior Cab Company** has been incorporated with a capital of $5,000 to operate taxicabs, sell gas, oil and accessories. The incorporators are: A. C. Rains, W. E. Bryant, A. T. Ewing, E. N. Bryant and V. L. Williams. Correspondent, Denison, Watkins & White, 36 West Randolph street.

The **Aluminum and Brass Foundry Company,** 127 North Dearborn street, has been incorporated with a capital of $30,000 to manufacture and deal in aluminum, brass and metal products of all kinds. The incorporators are: Joseph N. Mashken, Joseph N. Eisminski and Paul Pilkie. Correspondent, K. P. Gugle, 127 North Dearborn street.—L. H. G.

DETROIT, MICH.

May 1, 1926.

Albert L. Bensette, manager of the Detroit branch of the **National Lead Company,** died at his home here recently after a short illness. He was born in Windsor, Ont., 35 years ago and had been associated with the National Lead Company for the last 17 years.

The **C. M. Hall Lamp Company,** Detroit, reports net profits for 1925 of $387,432 after all charges and federal taxes. This is equivalent to $1.93 a share on the 200,000 shares of no par stock outstanding, and compares with net profits of $269,472 or $1.34 a share reported for 1924. Stockholders have authorized an increase in capital stock from 200,000 shares of no par stock to 500,000 shares no par, and authorized issuance of $1,500,000 of bonds at interest rate not to exceed 7 per cent.

Current assets amounting to $2,778,624.52 are reported in the balance sheet of the **Bohn Aluminum & Brass Corporation** and subsidiaries as of December 31, 1925, with current liabilities of $995,673.90, a ratio of nearly three to one. Total assets are reported as $6,359,897.08. Land, buildings, machinery and equipment, less depreciation allowance are valued at $3,102,000.26. Miscellaneous accounts, claims and investments are listed at $217,047.80; patents, patent rights and good will at $92,804.64, and deferred items at $169,419.86. Liabilities include $1,500,000 of first mortgage seven per cent sinking fund gold bonds outstanding; $15,000 reserve for contingencies and 337,050 shares outstanding of an authorized capital of 350,000 shares of no par value stock, which with surplus, are carried in the balance sheet at a valuation of $3,849,223.18.

The **Ford Motor Company,** at Highland Park, Mich., in 1925, consumed 68,891,142 pounds of brass, bronze and other metals, an increase of 17,337,542 pounds, or 25 per cent over 1924. The smallest casting weighed but a fraction of an ounce, while the largest casting was of pure copper and weighed 2,300 pounds. The furnace equipment of the foundry consists of 12 one-ton capacity electric furnaces, 14 oil furnaces of 1,400-pound capacity, and six crucible furnaces of 500 pounds each.

The **Keeler Brass Company,** at Grand Rapids, it is announced, has awarded a contract to the **Owen-Ames-Kimball Company** for a two-story plant addition to cost approximately $60,000.

The **Michigan Valve & Foundry Company,** Detroit, has been awarded a contract to furnish the Detroit water board with gate valves.

The **St. Clair Stamping Company** has been incorporated at St. Clair, Mich., for the purpose of dealing in brass, bronze and copper products. It has a capital stock of $25,000. The stockholders are George A. Nelson, St. Clair, Joseph Kopitske and Adam Lawrence, 7602 Miller avenue, Detroit.

OTHER COUNTRIES

BIRMINGHAM, ENGLAND

April 16, 1926.

Birmingham hardware and metal conditions are generally favorable. Makers of brass and copper sheets maintain a good output. The new orders for shipbuilding have produced a feeling of confidence that copper tubes will be wanted, although the increasing use of motor vessels reduces the demand for boiler tubes. Larger quantities of rolled copper are ordered for working up by coppersmiths and other shipbuilding craftsmen. A little improvement has been noticed in orders for high-class brass fitments such as door handles, door plates and various metal fitments required especially in the fitting up of passenger ocean going vessels.

Makers of pressed goods in the brass trade are busy. In this branch the first quarter compares very favorably with that of last year. There is, however, keen competition with Germany, especially in Belgium and the Scandinavian countries, necessitating fine cutting of prices and reducing profits.

Trade in galvanized hollow ware shows some improvement, though in this department export business does not keep pace with progress in the home market. Exporting merchants report better sales to India and Australasia than a year ago, especially for various brass foundry lines. The trade in aluminum domestic vessels is increasing and those countries show a decided preference for the heavier though rather expensive ware on which Birmingham manufacturers specialize. Under the pressure of German competition, the Birmingham maker has placed a lighter article on the market which appears to meet a demand.

A most important branch of the tube trade is the supply of copper tubes for domestic water conveyance. Hundreds of tons of these tubes are being ordered from various Birmingham works, and the associations which have taken up propaganda in this direction on an extensive scale are very well satisfied with the results. Scotland and the North appear almost to have discarded lead and substituted copper, and Lancashire and Yorkshire are very good customers. The preference is very decided where the character of the water makes it specially destructive to lead. The latter material, however, appears to be preferred in the South, which is described as slow in recognizing the special virtues of copper.

A branch of the brass trade specially threatened by Germany is the manufacture of metal frames for ladies' handbags. During the war these could not be got in sufficient numbers, and some Birmingham factories took up the manufacture, with very satisfactory results. Recently Germany has entered the field and is sending large quantities over at prices said to be quite impossible to the home manufacturer. As usual, however, the maker finds some compensation in foreign business, large consignments being sent to Australia, New Zealand and various colonies.

Makers of motor accessories are very busy and are generally preparing for a big season, although the motor trade so far has not come up to expectations. In certain lines American mass production has led to the capture of certain branches of the trade. This applies especially to door handles and certain parts of driving gear which are sent over here in large quantities at very low competitive prices. The makers of wireless non-ferrous parts are very busy and this line is increasingly a staple Birmingham industry. Makers of pens and other small metal products have changed over to wireless units with very great success. In enameled hollow ware, business is described as patchy, and the real activity is restricted almost entirely to the large concerns, with the latest equipment able to produce on mass lines. There are great complaints that the jewelry and electro-plate trades continue decidedly unsatisfactory.—J. H.

Business Items—Verified

The **General Plate Company,** Attleboro, Mass., is erecting a new plant, 50 ft. x 210 ft., in that city.

J. L. Mitchell Jewelry Company, 614 Fannin street, Houston, Texas, has increased its capital stock from $30,000 to $100,000.

The **U. S. Smelting Refining and Mining Company,** New York, has removed its offices from 120 Broadway to Room 1600, 57 William street.

The **Watson-Stillman Company's** main office and sales department are now located in the Evening Post building, 75 West street, New York.

The **Pequot Brass Company,** Norwich, Conn., announces the new location at the Shore Line Car Barn Property (Hallville District), recently purchased.

Lewis Roe, Bible House, New York, has enlarged his warehouse in Brooklyn, and carries a complete stock of polishing and plating supplies. He carries a stock of buffs at his office.

The **Crowe Name Plate and Manufacturing Company,** Chicago, Ill., is making a small addition adjacent to its plant on the east. This addition will house the preparation and die department.

The **Eastman Manufacturing Company,** Manitowoc, Wis., manufacturer of hose couplings and similar metal products, has engaged Smith and Brandt, architects, Appleton and Manitowoc, to prepare plans for a $25,000 addition. This firm operates a brass machine shop.

The **Standard Brass Manufacturing Company,** Port Arthur, Texas, has plans for a one-story machine shop, 50 x 112 ft., to cost about $70,000 with equipment. This firm operates the following departments: bronze, aluminum foundry; brass machine shop, tool room.

The **Ferro Enamel Supply Company** of Cleveland, Ohio, announces the appointment of Major Wilfrid Mavor as its eastern representative. Major Mavor also takes care of the Canadian business of the company. Jack Rumer is the representative in the Chicago district.

The **John Hassell, Inc.,** Clay and Oakland streets, Brooklyn, N. Y., manufacturer of rivets, wire nails, etc., is now building a three-story reinforced concrete addition, 75 ft. x 100 ft., to cost $90,000 without equipment. This company operates the following departments: tool room, plating.

The **U. T. Hungerford Brass & Copper Company,** New York, announces the opening of a new warehouse at 312-14 North 2nd street, St. Louis, Mo., where it is equipped with extensive assortments of its "Star Brand" copper, brass, bronze, and nickel silver sheets, tubes, rods, wire, etc.

The **Apex Bronze & Brass Works,** Oakland, Calif., are erecting a building on Adeline, near Thirtieth streets, which will soon be ready for occupancy. This firm specializes in the production of brass and bronze casting. E. C. Matignon is president, and George L. Roberts is production manager.

The **Ferro Enamel Supply Company** of Cleveland, Ohio, recently completed installation of a large "Aluminum" enamel burning furnace in the plant of the Belleville Enameling & Stamping Company, Belleville, Illinois. At the same time oil-burning equipment was installed on all of the furnaces and on the smelter in the Belleville plant.

The **Loeffelholz Company,** 170-82 Clinton street, Milwaukee, Wis., desires information covering equipment used in foundry, polishing, plating, or brass machining industry; also on water bumbling barrels. This firm operates the following departments: brass, bronze, aluminum foundry; grinding room, plating, japanning, polishing, lacquering.

The **Charles B. Dyer,** 234 Massachusetts avenue, Indianapolis, Ind., jewelry manufacturer, has awarded a general contract to the Hall Construction Company, for a new one-story factory, 30 ft. x 150 ft., to cost $25,000. This firm operates the following departments: tool room, casting shop, plating, stamping, soldering, polishing, lacquering.

According to press reports the **Aluminum Company of America,** the **General Electric Company** and the **E. I. du Pont de Nemours Company** own the **Frontier Corporation,** which has applied for permission to develop the water power of the St. Lawrence River in New York State. This, it is claimed will eliminate the need for using more Niagara power.

The name bronze plates of the **Mechanics and Metals** Bank, Pine and Nassau streets, New York, were removed recently, to be replaced with tablets of the Chase National Bank, with which the former institution has been merged. The Mechanics and Metals was in business for 116 years and was one of the oldest financial institutions in the country. Both names are familiar to metal men.

Approximately 40,000 square feet of floor space will be added to the plant of the **Keeler Brass Company** on Godfrey avenue, S. W., Grand Rapids, Mich., by the erection of a two-story and basement addition. The addition will cost approximately $60,000. This firm operates the following departments: brass, aluminum foundry; brass machine shop, tool room, grinding room, spinning, plating, japanning, stamping, soldering, polishing, lacquering.

The **E. Ingraham Company,** Bristol, Conn., is going to erect a five-year warehouse approximately 80 ft. x 125 ft., a one-story addition to its plating room (which will be used for a lacquer room), two additional kiln driers, an elevator and stairway tower added to the case department, and a small one-story addition to the hardening shop, garages, etc. This firm

operates the following departments: tool room, plating, stamping, soldering, polishing, lacquering.

Hydraulic machinery contracts for 17 units totalling nearly half a million horsepower have lately been secured by the William **Cramp & Sons Ship and Engine Building Company,** its subsidiaries and licensees. The turbines, water wheels and other hydro-electric devices comprising these orders will be installed in Brazil, Japan, Canada and the United States. One contract calls for a 56,000-horsepower impulse wheel, the highest powered of its kind in the world.

The **Cincinnati Manufacturing Company,** 1900 Gest street, Cincinnati, Ohio, manufacturer of architectural iron and bronze products, has awarded a general contract to the H. C. Hazen Company, Reading Road, for a five-story addition, 60 ft. x 75 ft., with one-story extension 25 ft. x 30 ft., to cost about $100,000 with equipment. A. H. Shoenberger is president. This firm operates the following departments: brass, bronze foundry; tool room, grinding room, brazing, plating japanning, soldering, polishing, lacquering.

The **Wellman Bronze Company,** Cleveland, Ohio, has dismantled the plant of the City Brass Foundry Company, and moved the equipment to its enlarged plant at 6017 Superior avenue. With the increased capacity the Wellman Bronze Company has one of the largest foundries in Cleveland given over entirely to the manufacture of brass, bronze and aluminum castings. This firm operates the following departments: bronze, aluminum foundry; brass machine shop, casting shop, plating, polishing, lacquering.

Industrial and Financial News

NEW INCORPORATIONS

The **Metal Products Manufacturing Company** has been organized at Seattle, Wash., to manufacture wood and metal products. This firm will operate the following departments: brass machine shop, tool room, grinding room, stamping, lacquering.

A new company has been formed, known as the **Lancaster Metalcraft Corporation,** Columbia, Pa. This firm will operate a tool room; plating, stamping, soldering, polishing and lacquering departments. The company is interested in an elevator and several punch presses.

The **St. Louis Aluminum Company,** 115 North Second street, St. Louis, Mo., has been incorporated with capital stock of $10,000, to manufacture aluminum products. This firm will operate the following departments: aluminum foundry, tool room, spinning, stamping, polishing.

The **Venetian Art Metal Lamp Company, Inc.,** 381 Broome street, New York, has been incorporated with capital stock of $12,000 to manufacture metal lamps, also cast iron novelties, such as book ends, etc. It is interested in getting in touch with foundries which manufacture metal novelties. This firm will operate the following departments: casting shop, soldering, polishing, lacquering.

National Aluminum Manufacturing Company, 107 Main street, Peoria, Ill., has been incorporated with a capital stock of $25,000, to manufacture and deal in brass, aluminum and metal cooking utensils and metal castings, etc. Incorporators are J. M. Liebig, L. F. Cavanaugh, J. F. Kelley. This firm will operate the following departments: brass, aluminum foundry; grinding room; polishing room.

The **Scovill Manufacturing Corporation** of Waterbury, Conn., will open on April 15, 1926, a new office and warehouse at 183 Public street, Providence, R. I. This corporation will sell the products of the Scovill Manufacturing Company which is a pioneer in the brass industry in America. Frank J. Colline will be in charge of the new office and warehouse and will have his headquarters in Providence.

The **Miller Manufacturing Company,** Fremont, Ohio, recently organized, will make aluminum flasks. The company receives the castings, grinds and assembles them, and ships the aluminum flasks; also cast iron jackets. This firm will operate the following departments: aluminum foundry, grinding room. Charles J. Miller is president; Joseph Karlovetz is manager, and Frank H. Snyder is purchasing agent.

The **Johnson-McKim-Johnson Company** has been incorporated to manufacture paints, varnishes and lacquers, and has purchased the plant formerly occupied by the General Carbonic Company, at Linden, N. J. Production commenced early in March. H. M. Johnson is president; J. E. Johnson, vice-president; W. A. McKim, secretary, and G. P. Taylor is chemical engineer. This firm will operate the following departments: grinding room, rolling mill, lacquering.

The **Akron Foundry Company,** 183 North Case avenue, Akron, Ohio, has been organized to do general jobbing work in gray iron, brass and aluminum castings. It has leased the property formerly occupied by the Banner Foundry Company. J. J. Criswell, for nine years superintendent of the foundry of the Falls Clutch and Machine Company, Cuyahoga Falls, Ohio, is president; J. Hofmann, for 18 years core department foreman for the same company, is vice-president, and W. E. Woodward, secretary and treasurer. This firm will operate the following departments: brass, bronze and aluminum foundry; casting shop.

The **Hardware Specialty Manufacturing Company,** a new firm recently incorporated under the laws of Ohio, has purchased and is now operating the plant formerly known as the F. J. Shively Company, located at 118-7th street S. W., Canton, Ohio. The new company will continue to manufacture a complete line of kitchen knives with patented finger protectors. Other articles will include a meat roller; a weeder for pulling weeds out of the lawn; also a complete line of shoe and leather knives with patented finger protectors. The officers of the new company are: M. M. Moore, president and treasurer; Lew S. Motz, vice-president; and H. S. Ernst, secretary and general manager.

CANADIAN ALUMINUM PROGRESS

The Aluminum Company of America, which is entering the Canadian industrial field on a large scale, has purchased the Duke-Price Power Company, Ltd., the organization formed by the late James B. Duke and the late Sir William Price, Canadian paper pulp magnate, to develop power resources on the Saguenay River in Quebec Province. In furtherance of the sale, a syndicate of banks including the Guaranty Company, Bankers Trust Company and Union Trust Company of Pittsburgh underwrote April 27, 1926, an issue of $37,000,000 of 6 per cent bonds of the Duke-Price Power Company. These three institutions will head the syndicate which will offer the bonds in the New York market.

The issue of bonds for the Duke-Price Power Company, it is said, will offer opportunity for the Aluminum Company of America to repay the Duke and the Price interests for their majority holdings in this important Canadian development, as well as to furnish additional capital for a program of expansion which the Aluminum Company of America has under way in Canada.

A mortgage on the physical properties of the Duke-Price Power Company will form the basis for the new bond issue. The common stock will be retained by the Aluminum Company of America.

The Duke-Price Power Company was incorporated in Canada in 1924 to develop power at a point on the Saguenay River in Quebec, known as the Grand Discharge. The initial installation consisted of eight hydro-electric units to develop 360,000 horsepower. The ultimate capacity will be 540,000 horsepower. This property is to be linked with the Aluminum Company's development in Canada, and authority has already been granted to construct a transmission line connecting the Duke-Price Power development with the Shawinigan system in Quebec. This work is under way.

The Aluminum Company of Canada recently purchased the Roberval-Saguenay Railway and the dock and loading equipment at Port Alfred for $1,900,000. Officials and directors of the Aluminum Company of America are said to plan a further extensive development in Canada.

Inauguration of the $75,000,000 industrial plant of the Aluminum Company of Canada at Arvida in the Province of Quebec will take place on June 1, 1926. The development includes both factory construction and power expansion. The works are to be supplied with bauxite direct from the mines of South America,

and will be used for aluminum ware, a market for which is expected in Ontario as well as in the Province of Quebec and other parts of Canada.

The promoters of the Arvida enterprise anticipate that a city of 150,000 will spring up within the next few years around the aluminum company's plant along the shores of the Saguenay River. It is estimated that the power plant will be capable of transforming the energy of the Saguenay into more than 1,000,000 horsepower.

Ground for this project, which it is stated will produce from four to five times the primary power of Muscle Shoals, was broken last September.

BOSSIER REORGANIZATION

The Boissier Electric Company, formerly of Long Island City, N. Y., is being reorganized by A. A. Mery in conjunction with officials of the Hanson & Van Winkle Company, Newark, N. J. The Boissier Electric Company has been incorporated as the Boissier Electric Corporation and contracted with the Hanson & Van Winkle Company to manufacture its products, including generators, motor generator sets, panel switchboards, rheostats, copper conducting rod systems, steel tanks, wood tanks lined and unlined anodes, electro-depositing plants for rotogravure cylinders, electrotyping and electro-plating equipment, together with a full line of polishing equipment and supplies. A. A. Mery is secretary and general manager of the Boissier Electric Corporation.

MANHATTAN BRASS LIQUIDATION

All the assets of the Manhattan Brass Company of New York, including the real estate and business of the company, was purchased by Robert B. Bowler of that city.

All orders at present unfinished are to be completed, after which the stock, finished and unfinished, will be disposed of, and negotiations are pending looking toward the disposal of all special machinery, dies and equipment. The Manhattan Brass Company is one of the few concerns that can turn out the finished product from the raw material all under its own roof and for this reason the company filled many orders for depth bombs used by the allied fleet during the war.

G. E. Smith, the president of the company, is a well known figure in the brass industry having been engaged in it for over 25 years.

COPPER IN RADIO

Rate of copper consumption in the radio industry is estimated to have more than doubled in the past two years and is now approximating 10,000,000 pounds a year, according to a survey just completed by the Copper & Brass Research Association. From an average of 2½ pounds per set in 1924, and 4 pounds in 1925, copper consumption has been increased 1½ of 6 pounds per set through new refinements and new installations. In some types of equipment total use of copper now runs to 10 pounds per set.

FORD'S METAL CONSUMPTION

Ford Motor Company's brass foundry at Highland Park in 1925 consumed 68,891,142 pounds of brass, bronze and other non-ferrous metals, increase of 17,337,542 pounds of 25 per cent over 1924. Of this amount 65,420,181 pounds were used in production of the Ford model T, the truck, tractor and Lincoln, 960,836 pounds by the Detroit, Toledo & Ironton Railroad and 2,510,125 pounds were for miscellaneous and special castings.

AUTOS USE MORE COPPER

The Copper and Brass Research Association issued an estimate that the consumption of copper by the automobile industry in 1925 totaled more than 245,000,000 pounds, a new record for all time.

LEAD CURE FOR CANCER

Dr. Blair Bell of London, England, reported that of 227 cases of cancer who had been called incurable, and whom he had given his lead treatment, 31 had recovered and ten had had the disease completely arrested.

TURKEY'S FIRST BRONZE STATUE

The first statue in Islam—a bronze figure of Mustapha Kemal of heroic size—was shipped to Constantinople March 13, 1926, by the Viennese sculptor, Heinrich Krippel. It will be erected shortly at the Seraglio, where the Bosporus meets the Golden Horn, thus occupying as commanding a position at Constantinople as the Statue of Liberty does to New York.

LARGE ALL-METAL AIRSHIP

Carl F. Fritsche, General Manager of the Aircraft Development Corporation of Detroit, announced in an address before the American Society of Mechanical Engineers at the Engineers' Club, New York, that his company was planning to build an all-metal airship with a capacity of 5,000,000 cubic feet of gas, nearly two and one-half times the size of the Shenandoah. He predicted that the ship because of its greater cargo-carrying capacity would be better for commercial purposes that the airplane and that metal-clads could carry a greater load in proportion to weight than the fabric-covered Shenandoah and Los Angeles carried.

BERYLLIUM ALLOYS

Beryllium, a metal with remarkable properties, is now available to industry. Cleveland scientists have devised a process by which it can be derived inexpensively from its ore, it was announced January 4, 1926.

Costing $5,000 a pound until a few years ago, it soon is to go on the market at $200 a pound.

Alloyed, beryllium furnishes an entire series of new materials for metal manufacturing. It weighs 30 per cent less than aluminum, and while aluminum melts at 660° C. beryllium stands up under 1278° C.

STANDARDIZING SCREW THREADS

The American Engineering Standards Committee, 29 W. 39 Street, New York, and the National Screw Thread Commission have invited the British Engineering Standards Association to a conference to consider the possibility of unifying the American and British screw thread systems.

A fundamental difference between the two national systems exists, however, with regard to the angle of thread. This angle is 60 degrees for the American, and 55 degrees for the British thread.

The importance of a possible unification between the two screw thread systems will be obvious if one realizes the innumerable applications of threaded parts in modern manufacture.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	...	$ 63	$ 66
American Hardware Corporation	$100	78	80
Anaconda Copper	50	43⅞	44
Bristol Brass	25	6	9
International Nickel, com	25	36½	37
International Nickel, pfd	100	...	102
International Silver, com	100	93	96
International Silver, pfd	100	100	105
National Enameling & Stamping	100	26	27
National Lead Company, com	100	148	150
National Lead Company, pfd	100	117½	118½
New Jersey Zinc	100	185	190
Rome Brass & Copper	100	130	138
Scovill Manufacturing Company	...	225	235
Yale & Towne Mfg. Company, new	...	61⅞	62½

Corrected by J. K. Rice, Jr., Co., 120 Broadway, New York.

SURVEY PROGRESS WASTE ELIMINATION

Extent of progress in waste elimination during the last five years will be the topic to be considered by meetings forming a progress of "Management Week," to be held in over 100 leading commercial and industrial centers during the last week in October. This was announced today by Ray M. Hudson, Chief of the Division of Simplified Practice, U. S. Department of Commerce, who has been made secretary of a national committee comprising the American Society of Mechanical Engineers, American Institute of Accountants, American Management Association, Society of Industrial Engineers, the Taylor Society and the Division of Simplified Practice.

It is the hope of the committee of sponsoring organizations, that interest may be focussed on the gains in efficiency of management which have followed such surveys of wastes in commerce and industry as: "Waste in Industry," made by the Hoover Committee on Elimination of Waste in Industry; the Committee on "Business Cycles and Unemployment," and the National Distribution Conference.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President, Whitehead Metal Products Company of New York, Inc.

MAY 1, 1926.

Some disturbing whisperings concerning a possible slump in business were passed around quietly in the month just closed. Here and there rumor had it that business was not so good, and the same old element of fear that has so many times preceded a slump was dragged out of its hiding place. Inquiry in the trade indicated that all the mills are busy and practically all are running to capacity. In some lines record-breaking production is the rule.

It is probable that a lot of mischief is brewing if the whisperings referred to above continue. The mental attitude they create is unsettling and harassing, and in some quarters already there is seen an inclination to limit both current and forward commitments.

It is difficult to secure any advices as to why in a space of time extending over about forty-five days there should be a reversal of form in the business world; but it is possible that the drop in the stock market has made some people pessimistic. Some of those who are well informed are inclined to think that there will be no important slump in business.

Those mills fortunate enough to be in the position of supplying the refrigerator and ice machine manufacturers are receiving orders for large tonnages. The refrigerating industry is consuming unprecedented quantities of sheet copper, seamless copper tube, brass forgings and Monel metal. Huge orders for these items were placed during April and the manufacturers of refrigerating machines say that their business is only in its infancy, predicting this line will ultimately be the largest consumer of metals in the country. There are at present between four hundred and fifty and five hundred concerns manufacturing refrigerating machinery in the United States.

There is still a heavy demand for brass pipe and sheet copper from the building trade, and for copper products from the electrical trade.

Those products made of nickel including Monel metal and pure nickel are enjoying a continuance of the prosperous conditions that have prevailed in this line for many months. Some heavy contracts for hotel equipment of Monel metal and nickel were placed in April, including one for the new Statler Hotel in Boston. The Pennsylvania Railroad placed a large contract for Monel metal for use in the kitchens of a number of new dining cars being built at their Altoona shops. It would appear that a prosperous condition will prevail for producers of these metals for sometime to come.

Metal Market Review

Written For The Metal Industry By R. J. HOUSTON, of D. Houston & Company, Inc., Metal Brokers, New York

MAY 1, 1926.

COPPER

The copper market situation presented a fairly steady tone recently. Inquiries in March indicated considerable interest among buyers, and the month's business amounted to a substantial tonnage at 13⅞c @ 14c for shipment over the next three months. Irregularity of foreign markets, however, continued to reflect the absence of aggressive strength abroad. Apathy of European consumers has been a feature for sometime. This is considered a temporary tendency, and a return to more normal condition in Continental and English trade circles will undoubtedly recur to give decisive impetus to foreign demand.

Consumer demand in this country is on an enormous scale. The March shipments to domestic buyers were 177,146,000 pounds, against 140,812,000 pounds in February. Exports last month also showed a large increase, with foreign shipments of 88,746,000 pounds compared with 70,928,000 pounds in February. Output of refined copper last month amount to 243,596,000 pounds. Total deliveries in March exceeded production by 22,296,000 pounds. The latter figures represented the decrease in refined stocks on March 31.

ZINC

Conditions in this market were easier in April. Prices gradually sagged off owing to dullness of demand and depression of foreign market. A better tone has developed lately, however, and a firmer tendency is noted. Statistics for March showed heavy deliveries of 54,191 tons, against 47,196 tons for February. Production, however, was at the high level of 54,411 tons. Stocks at the end of March were 20,561 tons, as against 9,295 tons at end of 1925. The domestic shipments during March rose to 51,615 tons, and these heavy deliveries indicate a very large consumption. Demand is expanding in England, the attractive prices are now low enough to bring out orders on a larger scale.

TIN

Continued scarcity of supplies and a large consuming demand furnish the basis for the present high price levels for tin. The growing strength of the statistical position is an outstanding condition which gives promise of a firm market. There is no recent indication that production is increasing to occasion concern, or evidence that consumption is liable to get a serious setback in the near future.

Buyers displayed an active interest in the market during the past month, with requirements principally for nearby positions. Price fluctuations for prompt Straits tin were between 62½ cents and 64½ cents, with April delivery touching 62 cents. The market movements were naturally irregular and at times sensitive and apprehensive over developments which gave rise to any uncertainty regarding the situation. Recent interest has centered in deliveries over the next few weeks, but offerings for near positions are limited. American deliveries for March were 6,835 tons, and for first quarter of this year amounted to 20,425 tons, and compare with 21,460 tons for first quarter of last year, a decrease of 1,035 tons. Market at this writing is easier.

LEAD

Declining market values marked the course of events in April. There were two reductions by the leading producer of 8.20 cents to 8 cents and later to 7.85 cents New York basis. Consuming demand continues good, and there is an impression in well posted circles than the recent receding tendency of market is only a temporary development. The foreign situation was unsettled and weak lately. Uncertainty abroad had its effect locally and prices here were lowered to remove the hesitation among buyers and stimulate business. Improved conditions abroad are looked for which will lead to greater confidence and activity. The closing period of the month saw lead active and in good demand.

ALUMINUM

Consumption of aluminum is maintained in large volume. Prices reflect this condition in an impressive way. The firmness of values has been a marked feature for many months, and are in line with the prosperous developments in this industry. Virgin ingot for prompt and future shipment quotes 28 cents for 99% plus grade and 27 cents for 98-99% quality. Orders for second quarter delivery have been in large volume. Imports continue quite heavy, but these are being well absorbed by the domestic trade. Some importers are reported to have disposed of practically the full amount of their allotments for the current year. New uses for aluminum are being developed, and heavy requirements seem assured.

ANTIMONY

The strength of antimony is due to the firm attitude of Chinese holders and the control of the metal at that point. Recent demand has been limited and buyers are disposed to act with caution. Reports of an agreement between Chinese miners were in circulation lately and are taken to indicate the purpose to dominate, if possible, market conditions at the source of supply. Demand, however, will have to improve if the market succeeds in developing a further substantial advance. There were signs of willingness to negotiate sales at a shade below full quotations recently, but the result was not successful for carload lots.

At the end of the month antimony fell off sharply being quoted from 16 cents to 17 cents, spot, and for May-June shipments, 11¼ cents, c.i.f., New York.

SILVER

The silver situation presents features of unusual interest lately. Price movements recorded a drop to 63 cents an ounce a short time ago which compares with a high of 72⅞ cents in 1925. The low for last year was 66½ cents. The disturbed conditions in China and the agitation in India for placing that country on a gold basis have had their influence on the situation. A commission from England visited India to study the situation. They have returned to Great Britain and made their report, but that, apparently, is as far as matters have gone so far as it relates to any change. India and China were both recent buyers and sellers, but the general inquiry has not been strong enough to restore the market to the level of a few weeks ago. There is a fairly steady tone at present on basis of 63⅞ cents, but future tendencies depend largely on developments in China and India.

PLATINUM

The price situation shows little change, with present basis $106.25 per ounce. Current requirements are limited, and talk of new sources of supply coming into view tend to caution.

QUICKSILVER

Increased strength is noted in the market for quicksilver, and present indications are for a continued firm market. Foreign supplies are said to be extremely light, with offerings reserved for shipment or early arrival. Reports state that Italy and Spain will not be in position to submit offers for months. The London and New York markets are strong, with increased demand. The local quotations are $91.50 to $92 per flask. The signs are that good buying might result in higher levels, if not actual shortage.

OLD METALS

Business in old metals has been in fair volume in the eastern part of the country. Quieter conditions have prevailed in the Chicago and Detroit districts lately. Foreign demand fell off recently except for moderate quantities of scrap brass. Domestic consumers and dealers, however, have been fairly active at current prices. While the market for some lines was more or less uncertain over the situation in some of the new metals, there was a good volume of supplies represented in the trading here. Prices dealers pay are quoted at 11½ cents for heavy copper, 9½ cents for light copper, 7c@7¼c for heavy brass, 6c@6¼c for light brass, 9¼ cents for new brass clippings, 6¼c@6½c for heavy lead, 4½c@4¾c for battery lead, 4 cents for old zinc and 21c@21½c for aluminum clippings.

WATERBURY AVERAGE

Lake Copper—Average for 1925, 14.427—January, 1926, 14.25c—February, 14⅜c.—March, 14.25c.—April, 14.125c.

Brass Mill Zinc—Average for 1925, 8.263—January, 1926, 9.00c—February, 8.20c.—March, 7.80c—April, 7.45c.

Daily Metal Prices for the Month of April, 1926

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	*2	5	6	7	8	9	12	13	14	15	16	19
Copper (f. o. b. Ref.) c/lb. Duty Free...													
Lake (Delivered)	14.125	.....	14.125	14.125	14.125	14.125	14.00	14.00	14.125	14.125	14.125	14.125	14.125
Electrolytic	13.90	.....	13.85	13.85	13.85	13.75	13.70	13.70	13.75	13.85	13.85	13.85	13.80
Casting	13.40	.....	13.40	13.40	13.40	13.30	13.25	13.25	13.30	13.45	13.45	13.45	13.40
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	7.20	.....	7.20	7.20	7.10	7.00	7.00	7.10	7.15	7.175	7.10	7.05	7.05
Brass Special	7.30	.....	7.30	7.30	7.25	7.10	7.10	7.20	7.25	7.25	7.25	7.15	7.15
Tin (f. o. b., N. Y.) c/lb. Duty Free...													
Straits	64.00	.....	64.00	63.75	63.25	62.50	62.25	63.00	63.75	64.25	64.25	63.75	63.375
Pig 99%	63.00	.....	63.00	62.75	62.25	61.50	61.25	62.00	62.75	63.25	63.00	62.75	62.125
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	8.10	.....	8.10	8.05	7.90	7.80	7.60	7.60	7.80	7.80	7.90	7.90	7.70
Aluminum c/lb. Duty 5c/lb.	28	.....	28	28	28	28	28	28	28	28	28	28	28
Nickel c/lb. Duty 3c/lb													
Ingot	35	.....	35	35	35	35	35	35	35	35	35	35	35
Shot	36	.....	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	39	.....	39	39	39	39	39	39	39	39	39	39	39
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	18.25	.....	18.25	18.00	17.50	17.50	17.50	18.00	17.75	17.75	17.75	17.75	17.75
Silver c/oz. Troy Duty Free	65.25	.....	65.375	65.125	65.125	65.375	65.25	64.75	64.75	64.625	64.375	63.875	63.375
Platinum $/oz. Troy Duty Free	106.25	.....	106.25	106.25	106.25	106.25	106.25	106.25	106.25	106.25	106.25	106.25	106.25

	20	21	22	23	26	27	28	29	30	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free...												
Lake (Delivered)	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.00	14.113
Electrolytic	13.80	13.80	13.80	13.80	13.85	13.85	13.80	13.80	13.80	13.90	13.70	13.810
Casting	13.40	13.40	13.40	13.40	13.50	13.50	13.50	13.50	13.50	13.50	13.25	13.407
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	6.95	6.95	6.90	6.95	6.975	6.95	6.90	6.80	6.75	7.20	6.75	7.021
Brass Special	7.10	7.10	7.05	7.05	7.10	7.05	7.00	6.90	6.85	7.30	6.85	7.131
Tin (f. o. b., N. Y.) c/lb. Duty Free...												
Straits	62.625	62.875	63.00	63.25	64.00	63.75	63.125	63.25	63.00	64.25	62.625	63.381
Pig 99%	61.50	61.75	61.75	62.00	62.25	61.75	60.75	60.375	60.00	63.25	60.00	61.988
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	7.60	7.60	7.60	7.65	7.70	7.80	7.75	7.70	7.70	8.10	7.60	7.779
Aluminum c/lb. Duty 5c/lb.	28	28	28	28	28	28	28	28	28	28	28	28
Nickel c/lb. Duty 3c/lb												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	39	39	39	39	39	39	39	39	39	39	39	39
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	17.50	17.50	17.50	17.50	17.25	16.50	15.00	14.00	13.25	18.25	13.25	17.131
Silver c/oz. Troy Duty Free	63.50	63.25	63.00	63.625	64.50	63.875	64.00	64.375	64.625	65.25	63.00	64.381
Platinum $/oz. Troy Duty Free	106.25	106.25	106.25	106.25	106.25	106.00	106.00	106.00	106.00	106.25	106.00	106.202

*Holiday.

Metal Prices, May 3, 1926

NEW METALS

Copper: Lake, 14.00. Electrolytic, 13.80. Casting, 13.50.
Zinc: Prime Western, 6.80. Brass Special, 6.90.
Tin: Straits, 62.50. Pig, 99%, 60.00.
Lead: 7.70. **Aluminum**, 28.00. **Antimony**, 13.00.

Nickel: Ingot, 35. Shot, 36. Elec., 39. Pellets cobalt free, 40.
Quicksilver, flask, 75 lbs., $92.00. **Bismuth**, $2.70 to $2.75.
Cadmium, 60. **Cobalt**, 97%, $2.60. **Silver**, oz., Troy, 64.625.
Gold, oz., Troy, $20.67. **Platinum**, oz., Troy, $106.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10½to11¼
Brass Ingots, Red	11¾to12¾
Bronze Ingots	11¾to12¾
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to41
Manganese Bronze Ingots	13 to17
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	28 to45
Monel Metal Shot	32
Monel Metal Blocks	32
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18⅞to22½
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	70 to80
Phosphor Tin, no guarantee	65 to75
Silicon Copper, 10% ......according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
11½to11¾	Heavy Cut Copper	13 to13½
11¼to11½	Copper Wire	12¾to13
9¾to10	Light Copper	10¾to11¼
9 to 9¼	Heavy Machine Composition	10½to10¾
7¾to 8	Heavy Brass	9 to 9¼
6¾to 7	Light Brass	8 to 8¼
7¾to 8¼	No. 1 Yellow Brass Turnings	9½to10
8¾to 9¼	No. 1 Composition Turnings	10½to11
7¼to 7½	Heavy Lead	8 to 8¼
5 to 5¼	Zinc Scrap	6 to 6½
12 to13	Scrap Aluminum Turnings	15 to17
19 to20	Scrap Aluminum, cast alloyed	21 to22
22½to23	Scrap Aluminum, sheet (new)	24 to25½
38 to40	No. 1 Pewter	42 to44
12	Old Nickel Anodes	14
18	Old Nickel	20

Wrought Metals and Alloys

COPPER SHEET

Mill shipments (hot rolled)	21½c. to 22½c. net base
From stock	22½c. to 23½c. net base

BARE COPPER WIRE

16¼c. to 16⅜c. net base, in carload lots.

COPPER SEAMLESS TUBING

24¼c. to 25¼c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	21 c. net base
100 lbs. to 200 lbs. in one order	21½c. net base

ZINC SHEET

Duty, sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	11.25 net base
Casks, jobbers' price	12.50 net base
Open Cacks, jobbers' price	13.00 to 13.25 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price	40c.
Aluminum coils, 24 ga., base price	36.70c.
Foreign	40c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	58c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	50c.	Hot Rolled Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c or over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver, 64 to 66½c.

BRASS MATERIAL—MILL SHIPMENTS

In effect March 26, 1926
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.18⅞	$0.20⅜	$0.22⅛
Wire	.19⅜	.20⅞	.22⅞
Rod	.16⅝	.21⅛	.23⅛
Brazed tubing	.26⅞	......	.32⅛
Open seam tubing	.26⅞	......	.32⅛
Angles and channels	.29⅞	......	.35⅛

For less than 5,000 lbs. add 1c. per lb. to above prices.

BRASS SEAMLESS TUBING

23½c. to 24½c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	20⅞c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18⅞c. net base
Muntz or Yellow Rectangular sheet other Sheathing	19⅞c. net base
Muntz or Yellow Metal Rod	16⅞c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	26¾c.	10% Quality	29¾c.
15% "	28¼c.	15% "	33½c.
18% "	29½c.	18% "	36¾c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Hot Rolled Sheets (base)	42
Cold Drawn Rods (base)	43	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, May 3, 1926

ANODES

Copper:	Cast	21½c. per ib.
	Rolled	21⅛c. per lb.
	Electrolytic	18⅝c. per lb.
Brass:	Cast	20½c. per lb.
	Rolled	21⅛c. per lb.
Zinc:	Cast	14¼c. per lb.

Nickel:	90-92%	45c. per lb.
	95-97%	47c. per lb.
	99% plus	49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 67c. to 69c. per Troy ounce, depending upon quantity purchased.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$33.05–33.10
14" 20 ply 64/68 Unbleached	41.15–42.55
12" 20 ply 80/92 Unbleached	34.25
14" 20 ply 80/92 Unbleached	46.40
12" 20 ply 84/92 Unbleached	40.70–45.25
14" 20 ply 84/92 Unbleached	55.20–60.55
12" 20 ply 80/84 Unbleached	40.15–41.35
14" 20 ply 80/84 Unbleached	54.40–55.70

Sewed Pieced Buffs, per lb., bleached .70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.12–.16
Acid—Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., Carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., Carboys	lb.	.02
Alcohol—Butyl	lb.	.18–.22½
Denatured in bbls	gal.	.40
Alum—Lump Barrels	lb.	.03¼
Powdered, Barrels	lb.	.042
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride solution in carboys	lb.	.06¼
Ammonium—Sulphate, tech, bbls	lb.	.03¾
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.05½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls	lb.	.30
Copper— Acetate (Verdegris)	lb.	.37
Carbonate, bbls	lb.	.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls	lb.	.05
Cream of Tartar Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59–.61
Iron, Sulphate (Copperas), bbl	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.15
Nickel—Carbonate dry, bbls	lb.	.29
Chloride, bbls.	lb.	.21
Salts, single 300 lb. bbls	lb.	.10½
Salts, double 425 lb. bbls	lb.	.10
Paraffin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic Electrolytic 88-92% fused, drums	lb.	.09¼
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 80-85%	lb.	.06
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide (Fluctuating Price)	oz.	.66
Nitrate, 100 ounce lots	oz.	.45½
Soda Ash, 58%, bbls	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.20
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls	lb.	.04¾
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass), bbls	lb.	.02
Sulpho Cyanide	lb.	.45
Sulphur (Brimstone), bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.43
Tripoli, Powdered	lb.	.03
Wax—Bees, white ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½–.06
Zinc, Carbonate, bbls	lb.	.11
Chloride, casks	lb.	.07⅜
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03⅛